U.S. Army Corps of Engineers
Omaha District

Technical Project Planning Meeting Package Cold Springs Precision Bombing Range
FUDS ID F10OR0172

Site Inspections at Multiple Sites, NWO Region Formerly Used Defense Sites, Military Munitions Response Program

Contract No. W912DY-04-D-0010
Delivery Order No. 003

April 9, 2007

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
AOC	area of concern
ASR	Archives Search Report
bgs	below ground surface
CSM	Conceptual Site Model
DQO	Data Quality Objective
FS	Feasibility Study
FUDS	Formerly Used Defense Site
HRS	Hazard Ranking System
lb	pound
MC	munitions constituents
MEC	munitions and explosives of concern
mm	millimeter
MRSPP	Munitions Response Site Prioritization Protocol
NBEC	nitrogen-based explosive compound
NDAI	No Department of Defense Action Indicated
PA/SI	Preliminary Assessment/Site Inspection
PETN	pentaerythritol tetranitrate
Shaw	Shaw Environmental, Inc.
SI	Site Inspection
SQL	sample quantitation limit
SSWP	Site-Specific Work Plan
T&E	threatened and endangered
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance

Site: Cold Springs Precision Bombing Range

Location: Hermiston, Oregon

USACE District: Seattle

TPP #1 Meeting Location: Hermiston Conference Center. Hermiston, Oregon

TPP #1 Meeting Date: April 19, 2007

AGENDA

Monday April 19, 2007

- **Convene at Hermiston Conference Center**
  - **Introductions**
  - **Review Site Inspection Objectives**
    - **Goals, Objectives, and Roles & Responsibilities**
    - **Site Inspection Process**
    - **Technical Project Planning (TPP) Process**
    - **Review of Background Information**
- **Technical Project Planning Discussion**

- **Public Meeting**

Cold Springs Precision Bombing Range
Technical Project Planning Meeting
Hermiston Conference Center, Hermiston, Oregon
April 19, 2007

Name	Organization	Phone (W)	Phone (C)	Email Address

1.0 Administrative Information

The Technical Project Planning (TPP) Memorandum is one in a series of documents used during the Site Inspection (SI) process to document the information collected and processes used to evaluate Formerly Used Defense Sites (FUDS) for the possible presence of munitions and explosives of concern (MEC) and/or munitions constituents (MC). TPP Meeting information provided in the Memorandum reflects both the original version of information shared with meeting participants, as well as changes/updates to site-specific information obtained during the TPP Meeting.

The TPP Meeting for the former Cold Springs Precision Bombing Range will be conducted on April 19, 2007, at the Hermiston Conference Center located in Hermiston, Oregon. Representatives from the U.S. Army Corps of Engineers (USACE) – Omaha Design Center and Seattle District, the Oregon Department of Environmental Quality, and Shaw Environmental, Inc. (Shaw) will be in attendance. A site tour will not be conducted as part of this meeting.

The TPP Memorandum documents discussions for the TPP Meeting and includes the sections described below:

- **Administrative Information:** includes meeting logistics and the list of attendees;
- **Site Inspection Objectives:** provides the goal and objectives of the SI, roles and responsibilities, the SI process, and the TPP process;
- **Background Information:** includes site and project history, area physical setting, a summary of previous environmental work, and an introduction to the areas of concern (AOCs) addressed by the SI;
- **Conceptual Site Model (CSM):** used to identify environmental attributes, potential human and ecological receptors in the area's environment, and the relationships between these factors;
- **Proposed Sampling Scheme:** used to describe the type and quantity of samples to be taken, and the analytical methods to be used for characterizing the AOC;
- **TPP Notes and Data Quality Objectives (DQOs):** used to capture project and site-specific information as discussed during the TPP Meeting to ensure the necessary and appropriate information is shared among meeting participants, and that meeting participants concur with the identified goal, objectives, and approach used to complete the SI process; and
- **Worksheets:** includes the **Site Information Worksheet,** Draft **Munitions Response Site Prioritization Protocol** (MRSPP) **Data Gaps, and Hazard Ranking System** (HRS) **Data Gaps.**

2.0 Site Inspection Objectives

2.1 Goal

- The USACE is conducting SIs of FUDS properties to determine if any MEC or related MC is present on property formerly owned or leased by the U.S. Department of Defense.

2.2 Objectives

- Determine if the site requires further response action under CERCLA due to the presence of MEC or MC.
- Collect minimum information needed to:
    - Eliminate a site from further consideration if:
        - No evidence of MEC and
        - Concentrations of MC in site media samples are below background or below risk-based screening levels,
    - Determine the potential need for initiation of the Remedial Investigation/Feasibility Study (FS) if:
        - Evidence of MEC identified or
        - Concentrations of MC in site media exceed background and risk-based screening levels.
    - Determine the potential need for Time-Critical Removal Action or Non-Time Critical Removal Action based on risk to site users from MEC:
    - Provide sufficient data for the U.S. Environmental Protection Agency (USEPA) to complete the HRS
    - Evaluate the FUDS using the MRSPP.

2.3 Roles & Responsibilities

- **USACE:** Acts as the executing agency for the U.S. Department of Defense with regard to the FUDS program. In this role, the USACE has decision making authority and is responsible for ensuring work is conducted in accordance with applicable USACE and federal guidance. Additionally, USACE coordinates and works with project team members to meet needs expressed by regulatory agencies and stakeholders.
- **Regulatory Agency:** Participates in planning of SI activities to ensure the project meets applicable state standards and requirements.
- **Property Owner(s)**: Provides available and pertinent information about the area, provides insight on current and anticipated future land uses for the property, and participates in project team discussions.
- **Shaw**: As a contractor to the USACE, conducts work on behalf of the USACE, provides TPP materials, makes site information available to the project team through a web-based information portal, and conducts and reports SI activities.

2.4 Site Inspection Process

- Data review,
- TPP,
- Site-Specific Work Plan,
- SI field activities – reconnaissance, sampling, and analysis, and
- SI Report.

2.5 Technical Project Planning Process

- Conduct TPP Meeting(s)* with key organizations and stakeholders;
- Identify stakeholder(s) concerns;
- Identify all AOCs for this SI;
- Review site information;
- Verify current and anticipated future land use;
- Develop CSM;
- Identify data gaps;
- Plan how to address data gaps;
- Develop DQOs for meeting SI requirements; and
- Concur on SI field work approach.

* Second TPP Meeting to be determined by team members during the first TPP Meeting.

3.0 Background Information

Historical information contained in this package was obtained from the *Archives Search Report* (ASR) (USACE, 1997) and the *ASR Supplement* (USACE, 2004) for the Cold Springs Precision Bombing Range. In addition, information obtained from the *Cold Springs Precision Bombing Range FUDS Preliminary Assessment/Site Inspection Report* (Weston Solutions, 2005) prepared for the USEPA was used in the preparation of this document.

3.1 Site Name and Location

The former Cold Springs Precision Bombing Range or Cold Springs Bombing Range, identification number F10OR0172, is located approximately 9 miles east of the city of Hermiston in Umatilla County, Oregon (Figure 1, "Site Location").

3.2 Range Inventory

The Cold Springs Bombing Range is included in the Military Munitions Response Program Inventory in the *Defense Environmental Programs Fiscal Year 2005 Annual Report to Congress* (DoD, 2005) with range information as follows:

Range Name	Federal Facility Identification	Range Total Acres
Cold Springs Precision Bombing Range	F10OR0172	649

The ASR (USACE, 1997) indicates the area of the Formerly Used Defense Site (FUDS) site is 2,622.08 acres and the area of the range cell is 649 acres.

Range areas and coordinates are listed in the ASR Supplement (USACE, 2004) as follows:

Range Name	Range Identification	Approximate Area (acres)	UTM Coordinates (meters)
Bombing Target	F10OR017201R01	649	X: 336657.83 Y: 5079463.67

Coordinates for the ranges are in Universal Transverse Mercator, Zone 11, NAD 83.

3.3 Property History

The information presented in the following sections is primarily obtained from the ASR (USACE, 1997), the ASR Supplement (USACE, 2004), and the *Cold Springs Precision Bombing Range FUDS Preliminary Assessment/Site Inspection Report* (Weston Solutions, 2005).

3.3.1 Historical Military Use

- Land was acquired via purchase and lease in December 1941 and January 1942, by the Army (a total of 2,622.08 acres) for use as a precision bombing range for target practice.
- Site was used by several assigned military units for day and night training missions, including a squadron (the B-24 Bomber and the C-45 Cargo Aircraft) stationed at the Walla Walla Army Air Field.
- Three plotting and spotting towers, a pump house, and well were the only improvements to the site.
- Site used from 1942 to 1946 as a practice bombing range using only M38A2 100-pound (lb) practice bombs filled with sand or flour.
- Site was declared surplus in October 1946 by the Army
- The ASR reported that a document dated November 19, 1947, indicated "The lands have been examined and have been cleared of all explosives or explosive objects reasonably possible to detect by visual inspection." (USACE, 1997).

3.3.2 Munitions Information

- Historical records indicate that the site was only used for M38A2 100-lb practice bombs with spotting charges.
- One landowner dug up a 37-millimeter (mm) point detonating artillery round.

3.3.3 Ownership History

- Private parties owned the land prior to the Army. The land was used for grazing of livestock.
- Army acquired the site in 1942, 310.36 acres was obtained from the Department of Interior and 2311.72 acres were leased from private parties.
- In August 1947, the Army declared the property surplus.
- The property is currently used for irrigated farming. Current owners are:
  - Stahl Hutterian Brethren, 1485 North Hoffman Road, Ritzville, Washington
  - Royale Columbia Farms, P.O. Box 93, Hermiston, Oregon.

Physical Setting

3.3.4 Topography and Vegetation

- Located in the Columbia Basin Subprovince of the Columbia Intermountain Physiographic province.
- Primary landscape feature is high plain desert with low-lying vegetation. The entire bombing range is hilly (USACE, 1997).
- Elevation is (approximately 750 feet elevation.
- The site is currently used for irrigated farming.
- Slopes can range from 12 to 25 percent

3.3.5 Surface Water

- The Cold Springs Bombing Range is drained by an unnamed canyon tributary that drains to Despain Gulch.
- Despain Gulch flows northwest from the site into the Cold Springs Reservoir.
- Only intermittent streams exist at the site.

3.3.6 Sensitive Environments

- The United States Fish and Wildlife Service indicated the following Federally protected species may be found in the vicinity of the Cold Springs Bombing Range:
  - Bald eagle (threatened)
  - Ferruginous hawk (candidate)
  - Loggerhead shrike (candidate)
  - Snake River Chinook salmon (threatened)
  - Snake River sockeye salmon (endangered)
  - Interior redband trout (candidate)
  - Pacific western big-eared bat (candidate)
  - Laurence's milk-vetch (candidate)
  - Hepatic monkeyflower (candidate)
  - Columbia cress (candidate).
- The Oregon Nation Heritage Program indicated the following State-threatened and endangered species occur in the vicinity of the site:
  - Bald eagle (threatened)
  - Ferruginous hawk
  - American white pelican
  - Washington ground squirrel.

Additional information will be acquired from the Oregon Department of Fish and Wildlife and the U.S. Fish and Wildlife Service.

- Table 1 presents the Army's checklist for Important Ecological Places (IEPs). Based on the above information, Cold Springs Precision Bombing Range is considered an IEP.

3.3.7 Climate

- Precipitation is seasonal with an average of only 10 percent of the rainfall occurring between July and September. The average total precipitation is 8.92 inches (www.census.gov).

- The average annual maximum and minimum temperatures are 65.5 degrees Fahrenheit (°F) and 40°F, respectively (www.census.gov).

- Prevailing wind direction is from the southeast.

- Average annual snowfall is about 10 inches (www.census.gov).

Geologic and Hydrogeologic Setting

3.3.8 Bedrock Geology

Bedrock beneath Cold Springs Precision Bombing Range consists of basaltic rocks of the Columbia River Basalt Group. A thick sequence of volcanic flows that erupted between 12 and 17.5 million years ago. Groundwater occurs in interflow zones between individual lava flows.

3.3.9 Overburden Soils

- Surface layer (0 to 8 inches) is pale brown fine sandy silty clay.

- Subsoil (8 to 28 inches) is light brownish gray, very fine, sandy silty clay.

- Substratum (31 inches thick) is composed of light brownish, gray silty, sandy clay.

- Permeability is rapid in upper zone but moderate in lower zone.

3.3.10 Hydrogeology

- Shallow groundwater may occur in perched zones, but not in usable quantities.

- Aquifers are very deep (975 feet to 1,600 feet below ground surface [bgs]) and discontinuous.

- Entire area has undergone over drafting of groundwater resources and is experiencing water level decline.

3.4 Population and Land Use

3.4.1 Nearby Population

- The site is located 9 miles east of the city of Hermiston, Oregon.

- Approximately 14,657 residents per 2005 Bureau of Census population estimates, 2,665 persons per square mile.

3.4.2 Land Use

- Current land use is for grazing and irrigated farming.

- An underground gas pipeline is located just west of the target site.

3.4.3 Area Water Supply

- Groundwater is used for domestic drinking water, irrigation of agricultural crops, livestock watering, and industrial purposes.

- Domestic wells are located within 4 miles of the site (Figure 2, "Domestic Wells Within 4-Mile Radius").

- The Cold Springs Precision Bombing Range FUDS is located in the northeastern corner of the Lower Umatilla Basin Groundwater Management Area. This area was declared a GWMA by the ODEQ in 1990 when groundwater sampling in the 1980s demonstrated high nitrate concentration across the basin. This was attributed to irrigated agriculture, land application of food processing waste, livestock operations, domestic sewage, and military activities. Perchlorate was added as a contaminant of concern starting with the 2003 sampling event. A separate PA/SI was conducted by Weston concurrently for the North Morrow Perchlorate Study Area.

3.5 Previous Investigations for MC and MEC

- Figure 3, "Site Layout," presents a layout of the Cold Springs Precision Bombing Range.

- An ASR was issued in June 1997. The ASR documented that the Cold Springs Precision Bombing Range was used for practice bombing using the M38A2, practice bombs. Numerous M38MA2 remnants littered the northern and southern slopes of the target area. No intact spotting charges were found. There is no historical evidence that the range was ever used for gunnery practice. However, a 37-mm projectile was recovered by a landowner from the immediate area of the range. The projectile was likely dropped from a P-39 aircraft.

  The munitions used at the Cold Spring Precision Bombing Range and the associated MC are shown on Table 2.

- During June and July 1944, numerous fires were reportedly caused by dropping of M38-A2 practice bombs by units on training missions.

- Historical documentation revealed problems with accidental bomb releases during the month of May 1945:

  – One of the accidental bomb releases was due to the release in extended vision by the lead bombardier of a six ship formation. The 15 released bombs were located and disposed of.

- The second accidental release was the result of improperly adjusted bomb rack controls. The exact location of the bombs was not determined.

- On May 17, 1995, personnel from the USACE St. Louis District conducted a site visit. The team met with Mr. John Walchli, a long-time resident and lessee. Mr. Walchli informed the team of numerous discoveries of practice bomb remnants he made, and that he buried a large quantity of that material in the eastern portion of irrigation circle #22. Additionally, he showed the site inspection team a live 37-mm, point detonating artillery round which he unearthed in approximately 1975 from irrigation circle #20. Markings indicated it was a M55A1 practice round; however, it had a M56 fuze (which is highly explosive and point-detonating). The round was likely dropped from a P-39 aircraft. The team also met with Harold Nakamo (representative for Makami Farms). Mr. Nakamo indicated the greatest concentration of bomb remnants he observed was at irrigation circle #16.

- An ASR Supplement was completed in 2004 and indicated one range, the Bombing Target (USACE, 2004).

3.6 Other Land Uses that May Have Contributed to Contamination

- Other than farming and grazing activities, there are no known sources for contamination

3.7 Other Investigations

- A field sampling investigation of the Cold Springs Precision Bombing Range was conducted by Weston Solutions, Inc. in December 2004.

- A draft Preliminary Assessment/Site Inspection (PA/SI) Report was issued to the USEPA on April 25, 2005.

  - Soil, sediment, surface water, and groundwater samples were collected and analyzed to characterize the potential sources (i.e., the target area).

  - Samples were collected at potentially contaminated source areas and from areas that may have been contaminated by the migration of contaminants from their respective sources.

  - Contaminants of concern included target analyte list metals, nitrogen-based explosive compounds (NBECs), and perchlorate.

- Based on the human health and ecological targets, the PA/SI determined that the groundwater, surface water, and soil pathways are the only potentially significant pathways associated with the Cold Springs Precision Bombing Range (USACE, 2005).

4.0 Conceptual Site Model – Bombing Target

4.1 Overview

A site-specific CSM summarizes available site information and identifies relationships between exposure pathways and associated receptors. A CSM is used to determine the data types necessary to describe site conditions and quantify receptor exposure, and discusses the following information:

- Current site conditions and future land use;
- Potential contaminant sources (e.g., metals and explosives from bombs);
- Affected media;
- Governing fate and transport processes (e.g., surface water runoff and/or groundwater migration);
- Exposure media (i.e., media through which receptors could contact site-related contamination);
- Routes of exposure (e.g., inhalation, incidental ingestion, and dermal contact); and
- Potential human and/or representative ecological receptors at the exposure point. Receptors likely to be exposed to site contaminants are identified based on current and expected future land uses.

The CSM is evaluated for completeness and further developed as needed through TPP Meetings and additional investigation.

4.2 Background

The ASR (USACE, 1997) references a 1949 photograph that presents a description of the bombing target as follows:

> "A large and very distinct bullseye target with three rings. Radiating out from the middle ring are four straight lines, at 90 degree angles to each other. There are two tick marks on each line; these are marked at equal distances along the straight line. Outside of the circles and in the north east quadrant is a marking of an Arabic number 4. There are black dots in the area; these appear to be wells. Some are within the circles and some are just outside the circles. There do not seem to be any craters in the vicinity of the site. About 1,250 feet south of the bullseye target is a very small squatty target or marker. It has an elliptical outer ring with a white center. The elliptical shape is oriented in an east-west direction. From the center are two lines, ninety degrees to each other and radiating to the outer circle."

Figure 4, “Bombing Target,” presents a layout of the bombing target.

4.2.1 History of use

- Precision bombing range for night and day training missions.
- Army erected a three-tower target in 1942.
- Historical records indicate the range was used for M38A2 practice bombs (however, a 37-mm live artillery round was unearthed by a landowner).
- Figure 5, “Conceptual Site Model Precision Bombing Range,” illustrates the conceptual site model for the Bombing Target at the Cold Springs Precision Bombing Range.

4.2.2 Munitions and Associated MC

Area of Concern	Munitions	Munitions Constituents
Bombing Range	Practice Bomb, 100-pound (M38A2)	Sheet metal (chromium, iron, copper, lead, manganese, and nickel)
	Spotting Charge (M1A1)	Black powder (potassium nitrate, sulfur, and charcoal)
	Spotting Charge (M3)	Black smoke mixture, black powder (potassium nitrate, sulfur, and charcoal)
	Spotting Charge (M4)	FS smoke
	37-mm Practice Projectile (M55A1)	Steel (chromium, iron, copper, lead, manganese, and nickel)
	Fuze (M56)	Tetryl, lead, aluminum

4.2.3 Previous MEC Finds

- A 37-mm point detonating artillery round was unearthed by a landowner in 1975.

4.2.4 Previous MC Sample Results

- A field sampling investigation of the Cold Springs Precision Bombing Range was conducted by Weston Solutions, Inc. in December 2004.
- A draft PA/SI Report was issued to the USEPA – Region 10 on April 25, 2005, presenting the results of the December sampling effort.

- All source samples were analyzed for inorganics, perchlorate, and NBECs.
  - Laboratory results indicated arsenic, barium, chromium, cobalt, copper, lead, manganese, nickel, silver, vanadium, and zinc are present above their sample quantitation limit (SQL).
  - NBECs were not detected above SQLs and perchlorate was detected at 0.83 milligrams per liter at one source sample location (collected of surface soil at bombing range).
- Groundwater samples were collected from five domestic wells and analyzed for inorganics, perchlorate, and NBECs. None of the wells are located within the Bombing Target area of concern. However, two of the five wells are located within the 4-mile target distance limit.
  - Laboratory results indicated barium, chromium, copper, manganese, vanadium, and zinc are present above their SQLs.
  - Perchlorate was detected in three samples ranging from 0.25 to 1.2 parts per billion, which is below the DoD action level of 24 parts per billion.
  - NBECs were not detected above SQLs.
- Sediment target samples were analyzed for inorganics, perchlorate, and NBECs.
  - Inorganics were present above their respective SQLs.
  - Perchlorate and NBECs were not detected above SQLs.
- Surface water samples were analyzed for inorganics, perchlorate, NBECs, pesticides and polychlorinated biphenyls.
  - Inorganics were present above their respective SQLs.
  - Perchlorate was detected in all seven surface water samples.
  - NBECs and pesticides/ polychlorinated biphenyls were not detected above SQLs.
- One background soil sample was collected north of Cold Springs and one co-located set of sediment and surface water samples were collected from Cold Springs on Royal Columbia Farms property. The soil sample was analyzed for target analyte list metals, NBECs, and perchlorate. The sediment and surface water samples were analyzed for metals, pesticides/polychlorinated biphyneyls, and NBECs. Additionally, the surface water sample was analyzed for perchlorate.
- Based on the human health and ecological targets identified in the PA/SI (USEPA, 2005), it was determined that the groundwater, surface water, and soil pathways were the only potentially significant pathways associated with the site. Due to the limited number of soil

concentrations above background values, it is unlikely that the air migration pathway would significantly contribute to the site HRS score.

- A separate PA/SI was conducted by Weston concurrently for the North Morrow Perchlorate Study Area. Both PA/Sis share some of the same concerns, including the potential presence of perchlorate in groundwater and surface water.

4.2.5 Current and Future Land Use

- Site is privately owned.
- Currently the site is being used for irrigated farming and livestock grazing, this should continue into the future.

4.2.6 Ecological Receptors

- This FUDS does qualify as an IEPS because the habitat is known to be used by state and/or federal designated or proposed designated endangered or threatened species.

4.3 MEC Evaluation

- Only documented use was from 1942 to 1946 as a practice bombing range using M38A2 100-lb practice bombs with spotting charges.
- The M38A2 is a sand-filled or flour-filled bomb.
- The spotting charge contained black powder or a smoke mixture.
- Historical evidence indicates munitions debris litters the site. No MEC from the practice bombs.
- A practice 37-mm practice projectile with a non-standard point detonating sensitive fuze was found by a landowner approximately 1975. No other MEC or munitions debris associated with the 37-mm has been reported.
- The site is currently privately owned and is used for irrigated farming and livestock grazing.
- There is restricted access to the site.
- The target area is undeveloped between irrigated crop circles.
- The population density is less than 100 people per square mile.
- There are no residences located within 1-mile of the site.
- There are less than five occupied buildings within two miles of the site.

4.3.1 MEC Evaluation/Investigation Needed

- Visual field reconnaissance of the target area and irrigation circle #20 (where the projectile was discovered) will be conducted by a qualified unexploded ordnance (UXO) technician with the aid of a hand-held magnetometer.

4.4 MC Evaluation

- Munitions debris (i.e., 100-lb practice bombs with spotting charge) in the site soils.
- One 37-mm point detonating artillery round was found by a landowner approximately 1975.
- Figure 5 illustrates the conceptual site model for the Bombing Target and potential pathways of MC contamination.
- The site is currently privately owned and is used for irrigated farming and livestock grazing.
- There is restricted access to the site.
- The population density is less than 100 people per square mile.
- There are no residences located within 1-mile of the site.
- There are less than five occupied buildings within 2 miles of the site.

4.4.1 Overview of Pathways

Affected media and potential pathways for MC include:

- Soil: Soil is the primary medium of concern due to the presence of munitions debris (i.e., 100-lb practice bombs with spotting charges) and possibly MC in the soil resulting from the discharge of munitions into the bombing range. The soil also serves as a secondary source of air contamination.
- Sediment: Sediment may be potentially affected by surface water runoff from impacted soil areas.
- Surface Water: The Cold Springs Bombing Range is drained by Desrain Gulch and several small tributaries. Surface runoff to water bodies within the AOC is considered a complete pathway. Water and sediment within the water body provide potential exposure to MC. Surface water presents a possible completed pathway between MC and receptor.
- Groundwater: According to the ASR, groundwater at the site is not easily obtained. However during the PA/SI (Weston Solutions, 2005) five groundwater wells were sampled. Only two of the five wells are located within the 4-mile radius of the target area. Of those two wells, only one well detected perchlorate at 0.30 parts per billion, which is below the DoD action level of 24 parts per billion. Additionally, the well is screened from 375 to 720 feet bgs. Groundwater presents a possible completed pathway between MC and receptor.

- Air: Air is a possible completed pathway through inhalation of contaminated soil particles. The prevailing wind direction is from the southeast. Blowing dust from the target could mobilize soil particles. The pathway is considered to be complete.

- An analysis of exposure pathways and receptors for MEC is provided in Table 3.

4.4.2 Terrestrial Pathway

4.4.2.1 Sources of MC

- The PA/SI (Weston Solutions, 2005) determined that the groundwater, surface water, and soil pathways were the only potentially significant pathways associated with the site.

- MC from the spotting charges could include black powder, black smoke mixture, and FS smoke. MC from the 37-mm projectile fuze could include aluminum, lead, and Tetryl. Metals from bomb bodies (chromium, iron, copper, lead, manganese, and nickel).

- The ASR indicates that aerial photography shows the bombing target located near irrigation tract #16. This is a hill which drops off into a small canyon on the north, south, and west sides.

- The greatest concentration of practice bomb remnants was found in the vicinity of irrigation tracts #16 and #22.

- The 37-mm artillery round was located in an area believed to be irrigation tract #20.

4.4.2.2 Migration Pathway

- Wildlife and livestock in the area potentially may be exposed to MC through soil, sediment, and water pathways.

- Humans may come in contact with MC contamination through intrusive and nonintrusive work and recreational activities in areas where munitions debris may be present.

4.4.2.3 Land Use and Access

- Current land use is for irrigated farming and livestock grazing, it is assumed this use will remain the same in the future.

- The land is privately owned

- Access to the site is restricted.

4.4.2.4 Human Receptors

- The most likely current and future human receptors at the site would be the landowners and any workers.

4.4.2.5 Ecological Assessment

- Site has been determined to be an IEP based on potential for threatened and endangered (T&E) to use the property.
- The potential T&E species are listed in Section 3.3.6.
- The pathway for ecological receptors is complete.

4.4.3 Surface Water/Sediment Pathway

The Cold Springs Bombing Range is drained by intermittent drainage in Despain Gulch and several small tributaries. Surface runoff drainages within the AOC are considered a complete pathway. Sediment within the water body provides potential exposure to MC. Surface water and sediment present possible completed pathways between MC and receptor.

4.4.3.1 Sources of MC

- Metals (chromium, iron, copper, lead, manganese, and nickel).

4.4.3.2 Migration Pathway

- Despain Gulch drains to Cold Springs Reservoir.

4.4.3.3 Surface Water Use and Access

- Irrigation.

4.4.3.4 Human Receptors

- Workers.

4.4.3.5 Ecological Assessment

- According to the ASR, one bird and two fish federal T&E species may be present in the vicinity of the site; one State T&E species may be in the vicinity of the site; and seven candidate federal T&E species may be present in the vicinity of the site.

4.4.4 Groundwater Pathway

- Five wells were sampled during the PA/SA (Weston Solutions, 2005); however, only three of the wells detected perchlorate ranging from 0.25 parts per billion to 1.2 parts per billion, which is below the DoD action level of 24 parts per billion. Therefore, additional groundwater samples are not required.

4.4.5 Air Pathway

- Air is a possible completed pathway through inhalation of contaminated soil particles. The prevailing wind direction is from the southeast. Exposure to the air pathway is considered in the human health screening values and is not assessed further here.

4.4.6 MC Evaluation/Investigation Needed

- One soil sample is planned from near the center of the bombing target in an area with high concentration of practice bomb fragment (near irrigation circle #16). The sample would be analyzed for select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel) and explosives. The list is based on the expected metals from the munitions (bomb casing and fuze). Only black powder explosives were known to be used.

- Three surface soil samples (SS-CB001 through SS-CB003) and three subsurface soil samples (SB-CB001 through SB-CB003) were collected at the Bombing Target during the PA/SI (Weston Solutions, 2005) and analyzed for metals, NBECs, and perchlorate. Metals were detected above their SQLs but not in significant quantities compared to background soil values. Perchlorate and NBECs were not detected, except for one detection of perchlorate of 0.83 milligrams per kilogram in a surface soil sample (SS-CB001). Additional soil samples are not required from this area.

- One soil sample will be collected outside the bombing target area but within the FUDS in an area between crop circles, which have not been impacted by irrigation. The sample would be analyzed for select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel) and explosives. No soil samples meeting these criteria were collected during the PA/SI.

- One sediment sample will be collected in an area within and downgradient of the Bombing Target within Despain Gulch. The sample would be analyzed for select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel) and explosives.

- One sediment sample (SD-UT001) was collected in an unnamed tributary to Despain Gulch downgradient of the Bombing Target during the PA/SI (Weston Solutions, 2005) and analyzed for metals, NBECs, and perchlorate. Metals were detected above their SQLs with some constituents significantly above their background sediment values. Perchlorate and NBECs were not detected. Additional sediment samples are not required from this area.

- One sediment sample (SD-DG002) was collected downgradient of the Bombing Target and sample location SD-UT001 at the confluence of Despain Gulch and Cold Springs Reservoir during the PA/SI (Weston Solutions, 2005) and analyzed for metals, NBECs, and perchlorate. Metals were detected above their SQLs with constituents not significantly above their background sediment values. Perchlorate and NBECs were not detected. Additional sediment samples are not required form this area.

- Ten background soil and one background sediment sample will also be collected. The sample would be analyzed for select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel) and explosives.

- No surface water or groundwater samples will be collected from the Cold Springs Precision Bombing Range.

- No air samples will be collected from the Cold Springs Precision Bombing Range. Analytical results from soil samples can be used in the evaluation of the air pathway.

- The sampling locations and SQLs from the 2004 field investigation by Weston Solutions will be reviewed to determine if the analytical data meet the detection criteria specified for the FUDS program. Figures and tables indicating the sampling locations and results can be found in the Weston Solutions PA/SI Summary (USEPA, 2005). If data is of acceptable quality, then the planned sample locations will be compared to the actual locations already sampled to determine if the existing data can be utilized. Therefore, additional field sampling may not be required or may be reduced.

4.5 CSM Summary/Data Gaps

- MEC was established when a 37-mm practice projectile with a nonstandard point detonating sensitive fuze was found near irrigation circle #20 by a landowner.

- MC from the spotting charges could include black powder, black smoke mixture, and FS smoke. Metals from bomb bodies could include chromium, iron, copper, lead, manganese, and nickel.

- Some sampling for MC has been completed as part of USEPA's PA/SI (Weston Solutions, 2005). Perchlorate was detected in surface water and groundwater. Perchlorate was detected in one surface soil sample also.

Results of the current status of data requirements with respect to MEC and MC for the Bombing Target located at the former Cold Springs Precision Bombing Range are summarized below.

Pathway	Presence of MEC	Presence of MC	Proposed Inspection Activities
Soil	Yes, 37-mm projectile discovered near irrigation circle #20	Practice Bomb debris litters site.	Surface and subsurface soil samples were collected during the PA/SI (Weston Solutions, 2005).
Sediment	unknown	unknown	Sediment samples were collected during the PA/SI (Weston Solutions, 2005).
Surface water	unknown	unknown	Surface water samples were collected during the PA/SI (Weston Solutions, 2005).
Groundwater	unknown	unknown	No complete pathway. Groundwater samples were collected from domestic wells during the PA/SI (Weston Solutions, 2005).
Air	unknown	unknown	None

Analytical data gathered during the PA/SI may, or may not, fully meet the DQOs of the current supplemental investigation (i.e., the analytical methodology, analyte list, and detection limits

may, or may not, conform to the USACE Programmatic Sampling and Analysis Plan) (Shaw, 2006). Therefore, those analytical results previously collected are not interpreted with the sole purpose of making a determination that no further investigation is required. However, the previously collected data can be used reasonably to make a recommendation for no further action.

5.0 References

Interstate Technical and Regulatory Council, 2003, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges*

Shaw Environmental, Inc. (Shaw), 2006, *Type I Work Plan, Site Inspections of Multiple Sites*.

U.S. Army Corps of Engineers (USACE), St. Louis District personnel, 1995a, Mr. John Walchli, a long-time resident and lessee, Personal Communication, May 17.

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U.S. Army Corps of Engineers (USACE), 1997, *Archives Search Report (ASR) Finding, Cold Springs Precision Bombing Range Military Reservation, Umatilla County, Oregon*, Project No. F10OR017201, June.

U.S. Army Corps of Engineers (USACE), 2004, *ASR Supplement, Cold Springs Bombing Range*, November.

U.S. Census Bureau, Population Estimates, www.census.gov.

U.S. Department of Defense (DoD), 2005, *Defense Environmental Programs Fiscal Year 2005 annual Report to Congress*.

Weston Solutions, 2005, *Cold Springs Precision Bombing Range FUDS Preliminary Assessment/Site Inspection Report,* prepared for the U.S. Environmental Protection Agency.

Proposed Sampling Scheme

Proposed Field Investigation

The proposed field investigation and sampling to be conducted at the former Cold Springs Precision Bombing Range is detailed below and summarized in Table 4. Sampling locations are presented in Figure 6, "Proposed Sampling Locations, Cold Springs Precision Bombing Range." The investigation approach will be defined in more detail in a Site-Specific Work Plan (SSWP) that will be submitted to Oregon Department of Environmental Quality and other stakeholders for review. The SSWP will reference technical details including sampling and analytical methods that are described in the *Type I Work Plan, Site Inspections at Multiple Sites* prepared by Shaw and submitted to U.S. Army Corps of Engineers (USACE) as final in February 2006.

Reconnaissance

A field reconnaissance survey by a trained, unexploded ordnance (UXO) technician using a hand-held magnetometer will be performed in the areas surrounding irrigations circles #16, #20, and #22 to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions. Several transects will be walked during which visual observations and magnetic anomalies will be noted. Transects will be recorded using a global positioning system, and appropriate features influencing the survey will be noted, such as vegetation density and type, topography, etc. If MEC is found, the qualified UXO technician will attempt to make a determination of the hazard, and appropriate notifications will be made as detailed in the *Type I Work Plan, Site Inspections at Multiple Sites* and SSWP. Digital photographs will be taken to document significant features.

Visual reconnaissance surveys will also be performed at other sampling locations to aid in sample location selection and to allow the sampler to work safely.

Soils

Surface soil samples will be collected at a depth of approximately 0 to 6 inches below ground surface (bgs). Surface soil samples will be composite samples (7-point, wheel pattern with a 2-foot radius). No subsurface samples are planned.

One soil sample will be collected at the location of MEC or munitions debris at irrigation circle #16 or #22. If no MEC or munitions debris is located, a soil sample will be collected near the reported bombing target at irrigation circle #16. The sample will be analyzed for explosives (including nitroglycerin and pentaerythritol tetranitrate [PETN]) and select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel).

One soil sample will be collected in an area south of irrigation circle #16 in an area not impacted by irrigation and farming activities. The sample will be analyzed for explosives (including nitroglycerin) and select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel).

Sediment

Sediment samples will be collected from 0 to 2 inches depth but will be discrete samples in order to retrieve material from specific, localized, water collection areas.

One sediment sample will be collected from a water collection area downgradient of the Bombing Target within Despain Gulch. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including nitroglycerin and PETN.

Groundwater and Surface Water

No groundwater or surface water sampling is planned. Groundwater and surface water samples collected during the U.S. Environmental Protection Agency's (USEPA) PA/SI (Weston Solutions, 2005) are sufficient to meet data objectives.

Analyses

Soil samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) by USEPA SW-846 Method 6020A. Sediment samples will also be analyzed for the same metals by Method 6020A. Soil and sediment samples will be passed through an ASTM International No. 10 (2-millimeter [mm]) wire mesh sieve at the laboratory prior to analysis for metals in order to remove coarser particles and foreign objects, including large metallic fragments from the practice bombs, which have a low degree of bioavailability (Interstate Technical and Regulatory Council, 2003, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges*).

Soil and sediment samples will also be analyzed for explosives by USEPA SW-846 Method 8330A and for nitroglycerine and PETN by Method 8330A (Modified).

Background Sampling

Ten background soil and one background sediment sample will be collected. The composite soil sample locations will be determined in the field in areas that do not appear to have been impacted by past site operations. The background samples will be analyzed for Target Analyte List metals, plus molybdenum only. The soil background samples will be used to develop an upper tolerance limit for comparison of metals soil concentrations at the target areas. The background sediment sample data will provide data to compare sediment samples to background values.

TPP Meeting Notes and Data Quality Objectives

Site Inspection ***Technical Project Planning Meeting***
Cold Springs Precision Bombing Range ***April 19, 2007***

Technical Project Planning and Development of Data Quality Objectives

- The U.S. Army Corps of Engineers (USACE) Technical Project Planning (TPP) process is a four-phase process:
    - Identify the current project,
    - Determine data needs,
    - Develop data collection options, and
    - Finalize data collection program.
- The purpose of TPP is to develop data quality objectives (DQOs) that document how the project makes decisions.
- DQOs are intended to capture project-specific information such as the intended data use(s), data needs, and how these items will be achieved.
- Information captured through DQOs will be used as a benchmark for determining whether identified objectives are met.

TPP Phases

Phase I: Identify the Current Project

1. Team members identified to date include: USACE – representatives from the Omaha Design Center and the Seattle District, Shaw Environmental, Inc. (Shaw) as a USACE contractor, Oregon Department of Environmental Quality, and the leaseholders.

   Question: Is there any person or organization missing from this Team?

2. The area of concern (AOC) identified is:

   - Bombing Target

   Question: Are there any other AOCs to be identified?

3. Based on information available about the site and shared through discussions with the USACE, are there concerns about this area that have been expressed by the Oregon Department of Environmental Quality or USEPA, as well as by landowners.

   Question: Are there additional concerns or issues from landowners or other stakeholders regarding the Cold Springs Bombing Range site?

Question: Are there any administrative or stakeholder concerns or constraints that would prevent site inspection activities from going forward on the decision path for this site?

Phase II: Determine Data Needs

4. Existing site information includes an Archives Search Report (ASR) and ASR Supplement both prepared by the USACE in 1997 and 2004, respectively. In addition, a PA/SI was prepared for the USEPA by Weston Solutions in 2005.

   Question: Are there any other pertinent documents relating to the site available?

5. The site-specific approach for this Site Inspection (SI) involves collating and assessing available site information, to include site geology, hydrogeology, groundwater, surface water, ecological information, human use/access, and current and future land uses, as well as considering conduct of site inspection and sampling activities.

   Question: Are there any other site aspects/information that should be considered?

Based on site use, soil is the primary affected medium at the Cold Springs Precision Bombing Range. Sediment/surface water is a potential pathway of munitions constituents (MC) because intermittent streams at the site drain to Despain Gulch and several unnamed small tributaries. Air is also a potential pathway if soil particles become airborne. Considering current and future land use, primary receptors of any contaminants that may be present would most likely be workers and animals using the area.

Question: Do team members concur with the Conceptual Site Model (CSM)?

6. Technical considerations and/or constraints need to be identified and addressed before conducting any additional sampling, and would depend on the approach and additional data needs decided upon by team members.

   Questions:

   - **Are any data missing?**
   - **What is the nature of needed data?**
   - **What data gaps would additional data meet for making a decision about the site?**
   - **Are there any considerations/constraints that need to be addressed for collecting additional data?**

Phase III: Develop Data Collection Options

7. Proposed approach:

   1. Conduct surface reconnaissance with magnetometer focused within the target circle.

2. Find suitable soil background sample locations (two total) and sample.

3. Find suitable sediment background sample location (one total) and sample.

4. Collect composite soil samples and analyze for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives.

5. Collect discrete sediment sample from water collection areas at one location downgradient of the Bombing Target. Analyze for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives.

Question: Based on the desired decision endpoints and information known to date, what additional information is needed to reach a determination of No Department of Defense Action Indicated (NDAI) or further action?

Question: Are the stakeholders in agreement with the sampling approach program?

Question: Are the stakeholders in agreement with the proposed approach for collecting background data?

Phase IV: Finalize Data Collection Program

8. **Background data**.
Site sampling results will be compared to background concentrations. Site will be considered NDAI for MC if site results do not exceed background.

Question: What background data will be used for evaluation?

Are background data sets available from previous site studies?

Are background data sets available from statewide studies?

If background data are to be collected as part of the SI, how many samples will be collected and what methods will be used to define the background range and compare to site sample results?

Soil
Sediment
Surface water
Groundwater

9. **Human health screening level risk assessment**.
Sample results that exceed background will be compared to screening values. Site will be considered NDAI for MC if site results do not exceed screening values (depending also on ecological evaluation). What concentrations of potential contaminants of concern (metals and explosives) lead to decision end-points for human health?

Note: Oregon State standards are provided in Tables 4, 5, and 6.

Question: Are these the correct standards to be applied as screening values for human health risk assessment?

10. **Ecological screening level risk assessment.**
    The USACE has defined a process for conducting screening level ecological risk assessment (SLERA). A determination is first made whether the site qualifies as an Important Ecological Place (IEP). A second determination is made whether the site is managed for ecological purposes. If neither criterion is met, then a SLERA is not required and the process is limited to making observations during the site visit of any acute effects to flora and fauna that may be related to MC. If the site does qualify as an IEP or is managed for ecological purposes, site results that exceed background will be compared to ecological screening values. The site will be considered NDAI for MC if site results do not exceed screening values (depending also on human health evaluation).

    Does the site qualify as an IEP?

    Is the site managed for ecological purposes?

    If the site is an IEP or is managed for ecological purposes, what concentrations of potential contaminants of concern (metals and explosives) lead to decision end-points for ecological risk?

    Note: Oregon State standards are provided in Tables 4, 5, and 6.

    Question: Are these the correct standards to be applied as screening values for ecological risk assessment?

11. **Other sampling issues.**

    Question: Are there any additional sampling and analysis methodologies needed for all team members to arrive at a decision end-point?

    Question: Given the additional sampling and analysis methodologies, are there impacts to the project schedule that need to be accommodated?

Data Quality Objectives

Upon agreement at the TPP Meeting, the following decision rules will be applied with regard to MC sampling results:

- Below risk-based screening levels = NDAI;
- Above risk-based screening levels and background = Remedial Investigation/Feasibility Study (FS).

The following expanded project objectives have been developed.

Objective 1: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of munitions and explosives of concern (MEC).

DQO #1 – Utilizing trained UXO personnel and handheld magnetometers, a visual search will be conducted searching for physical evidence to indicate the presence of MEC, (e.g. MEC on the surface, munitions debris, craters, soil discoloration indicative of explosives. The visual search will consist of areas within irrigation circles #16, #20, and #22. The following decision rules will apply:

- The following reconnaissance results would support a recommendation for further action with respect to MEC:
    - Direct evidence is found of the presence of MEC (from historical records or SI activities) or evidence of potential MEC that is inconsistent with the bombing rocket range CSM (e.g. use of munitions containing high explosives).
    - Direct evidence of MEC is not found, but abundant munitions debris is identified suggesting a potential for the presence of MEC.
- The following reconnaissance results would support a recommendation for NDAI with respect to MEC:
    - Direct evidence of MEC is not found; munitions debris is isolated and consistent with the Bombing Range CSM.
    - No evidence of MEC, munitions debris, or magnetic anomalies is identified.
- If there is indication that site users are exposed to MEC hazard, the site will be recommended for a removal action.

Objective 2: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MC above background and screening values.

DQO #2 – Soil and sediment samples will be collected and analytical results will be compared to background. Results from previous investigations will also be included in the evaluation provided the analytical data meet data quality requirements developed for the SI. The following decision rules will apply:

- If sample results do not exceed background, the site will be recommended for NDAI relative to MC
- If sample results that exceed background are less than human health and ecological screening values, the site will be recommended for NDAI relative to MC.
- If sample results exceed both background and human health screening values, the site will be recommended for additional investigation.

- If sample results that exceed background exceed ecological screening values but not human health screening values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.

Objective 3: Obtain data required for Hazard Ranking System (HRS) scoring.

Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

Objective 4: Obtain data required for MRSPP ranking.

Data required for MRSPP ranking are identified in the MRSPP worksheet.

Next Steps

- USACE will obtain necessary rights-of-entry
- Shaw will prepare the final TPP Memorandum and distribute for concurrence.
- Shaw will prepare the SSWP for review and comment..
- Shaw will conduct field work.
- Shaw will prepare the SI Report and submit for stakeholder review.
- USACE/Shaw will schedule a second TPP Meeting to review comments on the draft report.

Figures

DRAWING NUMBER: Coldsprings_001_fig1_SiteLocation_TPP

DRAWN BY: M. Mireiter 3/21/07

OFFICE: CEN

320000 000000 330000 000000 340000 000000 350000 000000 360000 000000

5090000 000000

5080000 000000

5070000 000000

5060000 000000

Columbia River
Umatilla River
Umatilla
Juniper Canyon
Lake Wallula
Cold Springs Reservoir
Hermiston
Manns Pond
Stanfield
Echo
Pendleton
Mc Kay Reservoir

82 14 730 395 84 30 395

Legend

Cold Springs Bombing Range FUDS Boundary

NOTES:
1) FUDS boundary was derived from the Cold Springs Bombing Range ASR Supplement.
2) This property is located within the Umatilla Watershed.
3) Topo map (Umatilla County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.

N

0 1.5 3 6 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 1

SITE LOCATION

COLD SPRINGS PRECISION BOMBING RANGE

Shaw® Shaw Environmental, Inc.

DRAWING NUMBER: Coldsprings_004_fig2_GWWells_TPP

DRAWN BY: M. Mireiter 3/27/07

OFFICE: CEN

329400.000000 333600.000000 337800.000000 342000.000000 346200.000000

5084800.000000

5080900.000000

5077000.000000

5073100.000000

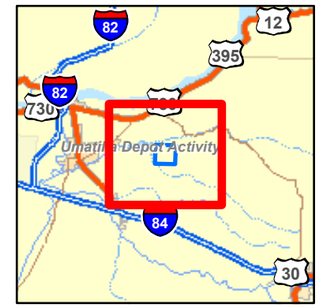
Bombing Target

Legend

- Cold Springs Bombing Range FUDS Boundary
- Range Included in the MMRP Range Inventory
- Domestic Well
- Industrial Well
- Livestock Well
- Irrigation Well
- USGS Monitoring Well

NOTES:

1) FUDS and range boundaries were derived from the Cold Springs Bombing Range ASR Supplement.
2) USGS well information obtained from the US Geological Survey.
3) Non-USGS groundwater well information obtained from the State of Oregon, Water Resources Department. Wells are plotted in the center of either the Township/Range/Section, Townwnship/Range/Section/Quarter, or Township/Range/Section/Quarter/Quarter depending on available well data.
4) Topo map (Umatilla County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



N

0 0.5 1 2 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 2

GROUNDWATER WELLS WITHIN 4-MILE RADIUS

COLD SPRINGS PRECISION BOMBING RANGE

Shaw® Shaw Environmental, Inc.

DRAWING NUMBER: Coldsprings_002_fig3_SiteLayout_TPP

DRAWN BY: M. Mireiter 3/21/07

OFFICE: CEN

332500.000000 334200.000000 335900.000000 337600.000000 339300.000000

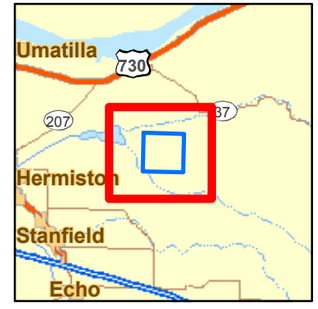
5083000.000000
5081500.000000
5080000.000000
5078500.000000
5077000.000000

Cold Springs Reservoir
Cold Springs Canyon
Irrigation Circle #20
Irrigation Circle #22
Bombing Target
Irrigation Circle #16
Despain Gulch
Lenz Lateral
Despain Gulch

Legend

- Cold Springs Bombing Range FUDS Boundary
- Range Included in the MMRP Range Inventory
- Domestic Well
- Industrial Well
- Livestock Well
- Irrigation Well
- USGS Monitoring Well

NOTES:
1) FUDS boundary and range boundaries were derived from the Cold Springs Bombing Range ASR Supplement.
2) USGS well information obtained from the US Geological Survey.
3) Non-USGS groundwater well information obtained from the State of Oregon, Water Resources Department. Wells are plotted in the center of either the Township/Range/Section, Townwnship/Range/Section/Quarter, or Township/Range/Section/Quarter/Quarter depending on available well data.
4) Aerial photo (Umatilla County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-AFPO National Agricultural Inventory Project, 2006.



N

0 0.25 0.5 1 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

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FIGURE 3

SITE LAYOUT

COLD SPRINGS PRECISION BOMBING RANGE

Shaw® Shaw Environmental, Inc.

DRAWING NUMBER: Coldsprings_003_fig4_BTrg_TPP

DRAWN BY: M. Mireiter 3/21/07

OFFICE: CEN

335000 336000 337000 338000 339000

5080750

5080000

5079250

5078500

5077750

Irrigation Circle #20

Irrigation Circle #22

Irrigation Circle #16

Bombing Target

005

003

002

004

001

Legend

- Cold Springs Bombing Range FUDS Boundary
- Range Included in the MMRP Range Inventory
- Taxlot Parcel
- Domestic Well
- Irrigation Well
- USGS Monitoring Well

NOTES:

1) FUDS and range boundaries were derived from the Cold Springs Bombing Range ASR Supplement.
2) USGS well information obtained from the US Geological Survey.
3) Non-USGS groundwater well information obtained from the State of Oregon, Water Resources Department. Wells are plotted in the center of either the Township/Range/Section, Townwnship/Range/Section/Quarter, or Township/Range/Section/Quarter/Quarter depending on available well data.
4) Aerial photo (Umatilla County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-AFPO National Agricultural Inventory Project, 2006.

N

0 625 1,250 2,500 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

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FIGURE 4

BOMBING TARGET

COLD SPRINGS PRECISION BOMBING RANGE

Shaw® Shaw Environmental, Inc.

XREF Files: IMAGE Files: airplane.jpg
File: O:\116188-FUDS-CAD\0670030\Rev-A\06700A01A.dwg Layout: Layout1 User: Michael.Crawford Apr 03, 2007 - 1:18pm

OFFICE	DRAWN BY		DRAWING NUMBER
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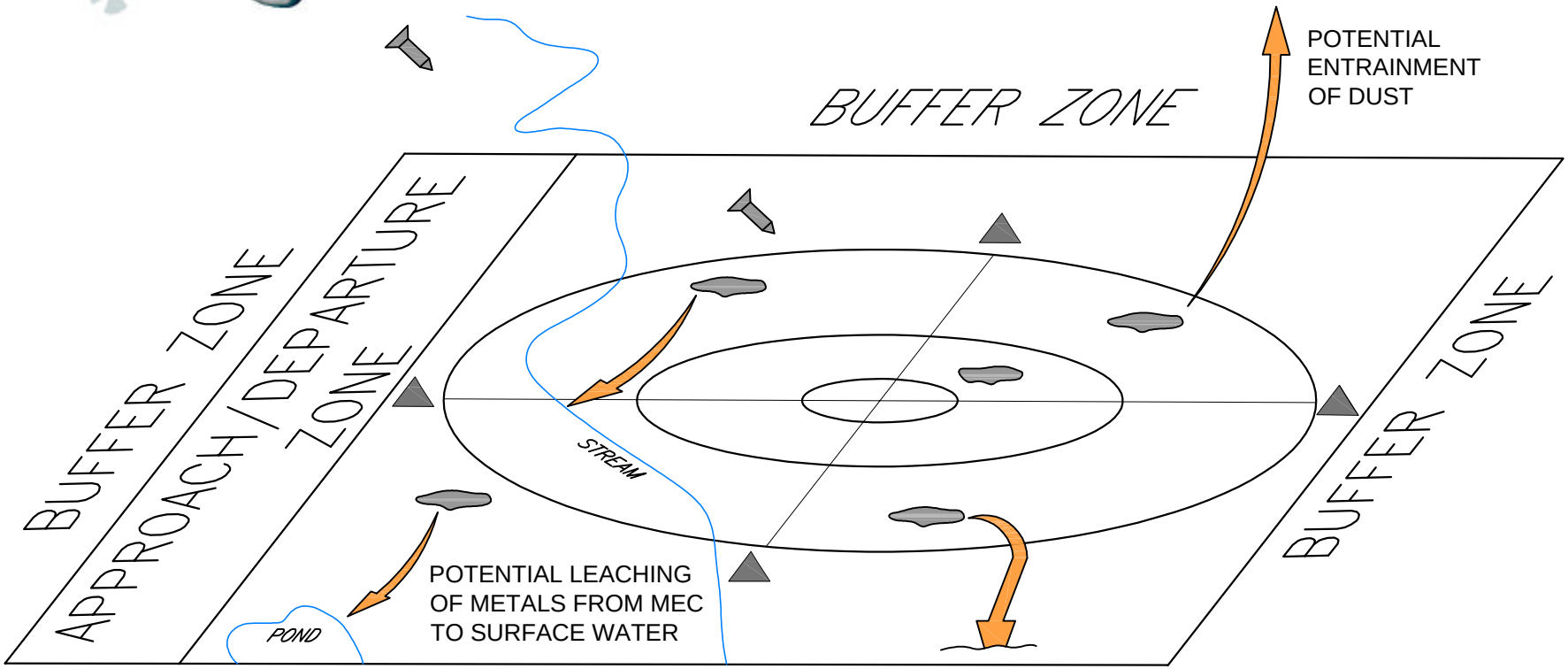

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FIGURE 5

CONCEPTUAL SITE MODEL
PRECISION BOMBING RANGE

COLD SPRINGS PRECISION BOMBING RANGE

Shaw Environmental, Inc.

DRAWING NUMBER Coldsprings_007_fig6_PropSampleLocs_TPP

DRAWN BY M. Mireiter 4/3/07

OFFICE CEN

335000.000000 336000.000000 337000.000000 338000.000000 339000.000000

5080750.000000

5080000.000000

5079250.000000

5078500.000000

5077750.000000

Irrigation Circle #20

Irrigation Circle #22

Irrigation Circle #16

Bombing Target

005

003

002

004

001

Legend

- Cold Springs Bombing Range FUDS Boundary
- Range Included in the MMRP Range Inventory
- Taxlot Parcel
- Domestic Well
- Irrigation Well
- USGS Monitoring Well
- Proposed Soil Sample
- Proposed Surface Water Sample

NOTES:

1) FUDS and range boundaries were derived from the Cold Springs Bombing Range ASR Supplement.
2) USGS well information obtained from the US Geological Survey.
3) Non-USGS groundwater well information obtained from the State of Oregon, Water Resources Department. Wells are plotted in the center of either the Township/Range/Section, Townwnship/Range/Section/Quarter, or Township/Range/Section/Quarter/Quarter depending on available well data.
4) Aerial photo (Umatilla County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-AFPO National Agricultural Inventory Project, 2006.

N

0 625 1,250 2,500 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

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FIGURE 6

PROPOSED SAMPLING LOCATIONS

COLD SPRINGS PRECISION BOMBING RANGE

Shaw Shaw Environmental, Inc.

Tables

Table 1. Army Checklist for Important Ecological Places [a]
Cold Springs Precision Bombing Range, Hermiston, Oregon

		Yes / No	Comments
1	Locally important ecological place identified by the Integrated Natural Resource Management Plan, BRAC Cleanup Plan or Redevelopment Plan, or other official land management plans	☐ / ☒	
2	Critical habitat for Federal designated endangered or threatened species	☐ / ☒	
3	Marine Sanctuary	☐ / ☒	
4	National Park	☐ / ☒	
5	Designated Federal Wilderness Area	☐ / ☒	
6	Areas identified under the Coastal Zone Management Act	☐ / ☒	
7	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program	☐ / ☒	
8	Critical areas identified under the Clean Lakes Program	☐ / ☒	
9	National Monument	☐ / ☒	
10	National Seashore Recreational Area	☐ / ☒	
11	National Lakeshore Recreational Area	☐ / ☒	
12	Habitat known to be used by Federal designated or proposed endangered or threatened species	☒ / ☐	ASR states that 1 bird and 2 fish federal T&E species may be in the vicinity of the Site.
13	National preserve	☐ / ☒	
14	National or State Wildlife Refuge	☐ / ☒	
15	Unit of Coastal Barrier Resources System	☐ / ☒	
16	Coastal Barrier (undeveloped)	☐ / ☒	
17	Federal land designated for protection of natural ecosystems	☐ / ☒	
18	Administratively Proposed Federal Wilderness Area	☐ / ☒	
19	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters	☐ / ☒	
20	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time	☐ / ☒	
21	Terrestrial areas utilized for breeding by large or dense aggregations of animals	☐ / ☒	
22	National river reach designated as Recreational	☐ / ☒	

Table 1 (Cont.)

		Yes / No	Comments
23	Habitat known to be used by state designated endangered or threatened species	☒ / ☐	ASR states that 1 state T&E species may be in the vicinity of the Site.
24	Habitat known to be used by species under review as to its Federal endangered or threatened status	☒ / ☐	ASR states that 7 candidate federal T&E species may be in the vicinity of the Site.
25	Coastal Barrier (partially developed)	☐ / ☒	
26	Federally designated Scenic or Wild River	☐ / ☒	
27	State land designated for wildlife or game management	☐ / ☒	
28	State-designated Scenic or Wild River	☐ / ☒	
29	State-designated Natural Areas	☐ / ☒	
30	Particular areas, relatively small in size, important to maintenance of unique biotic communities	☐ / ☒	
31	State-designated areas for protection or maintenance of aquatic life	☐ / ☒	
32	Wetlands	☐ / ☒	
33	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	☐ / ☒	

a – Based on EPA, 1990, 55 FR 51624, Table 4-23 – Sensitive Environments Rating Values, Dec. 14, 1990; EPA, 1997, ERAGS, Exhibit 1-1 List of Sensitive Environments

Table 2. Potential MEC and MC at Cold Springs Precision Bombing Range

Range Areas	Munitions ID	Munitions	Associated MC	Comments
Bombing Range	Practice bomb, 100-pound	M38A2	Chromium, iron, copper, lead, manganese, and nickel	Made of light sheet metal
	Spotting Charge	M1A1	Black powder (potassium nitrate, sulfur, and charcoal)	
	Spotting Charge	M3	Black smoke mixture, black powder (potassium nitrate, sulfur, and charcoal)	
	Spotting Charge	M4	FS smoke	
	Practice Projectile	37-mm M55A1	Chromium, iron, copper, lead, manganese, and nickel	Made of steel
	Fuze	M56	Tertryl, lead, aluminum	

Table 3. MEC and MC Exposure Pathway Analysis

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media (Potential Contaminant Sources) (Fate and Transport)	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Bombing Target	**MEC**	MEC in the form of *unexploded* practice bomb spotting charges may exist on the land surface. MEC in the form of *unexploded* projectile fuzes may exist on the land surface.	**Surface Soil** • MEC (unexploded practice bombs) are a hazard. • MEC (unexploded practice bombs) reported on surface.	• Potentially complete pathway. Exposure routes: • Vehicle and foot traffic	• Incomplete pathway.	• Potentially complete pathway. Exposure routes: • Foot traffic	• 37-mm live projectile found in irrigation circle #20.	• Historical documents indicate that the bombing target was used for 100-pound practice bombs. Does not indicate target was used for live projectiles. • A field reconnaissance survey by a trained, unexploded ordnance (UXO) technician using a hand-held magnetometer will be performed in the areas surrounding irrigations circles #16, #20, and #22 to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions.
			Subsurface Soil • MEC (unexploded projectiles) are a hazard. • MEC (unexploded projectile) reported in subsurface.	• Potentially complete pathway. Exposure routes: • Intrusive activities • Agricultural tiling	• Incomplete pathway.	• Potentially complete pathway. Exposure routes: • Burrowing • Agricultural tilling	• 37-mm live projectile found in irrigation circle #20.	• Historical documents indicate that the bombing target was used for 100-pound practice bombs. Does not indicate target was used for live projectiles. • A field reconnaissance survey by a trained, unexploded ordnance (UXO) technician using a hand-held magnetometer will be performed in the areas surrounding irrigations circles #16, #20, and #22 to assess the presence or absence of munitions and explosives of concern (MEC) and to document the current site conditions.
	MC	Black powder, sheet metal (chromium, iron, copper, lead, manganese, and nickel), steel , lead, aluminum	**Soil** • Directly affected. • Potential metals contamination from munitions used. • Spotting charges do not contain hazardous components. • Fuze does not contain hazardous substances. • Fate & Transport: secondary source of potential sediment, surface water, and air contamination.	• Potentially complete pathway. Exposure routes: • Incidental ingestion • Dermal contact • Inhalation of soil particles	• Incomplete pathway.	• Potentially complete pathway. Exposure routes: • Ingestion • Direct Contact	• Limited soil data for metals and explosives exist from PA/SI investigation. • Additional metals and explosives data may be needed.	One soil sample will be collected at the location of MEC or munitions debris at irrigation circle #16 or #22. If no MEC or munitions debris is located, a soil sample will be collected near the reported bombing target at irrigation circle #16. The sample will be analyzed for explosives (including nitroglycerin and pentaerythritol tetranitrate [PETN]) and select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel). One soil sample will be collected in an area south of irrigation circle #16 in an area not impacted by irrigation and farming activities. The sample will be analyzed for explosives (including nitroglycerin) and select metals (aluminum, chromium, iron, copper, lead, manganese, and nickel).
			Sediment/Surface Water • Potentially affected media – Despain Gulch • Potential metals contamination • Spotting charges and fuze do not contain hazardous substances • Fate & Transport: via surface runoff from impacted soil	• Potentially complete pathway. Exposure routes: • Incidental ingestion • Dermal contact • Inhalation of surface water	• Incomplete pathway.	• Potentially complete pathway. Exposure routes: • Ingestion • Direct Contact	• Limited sediment and surface water data for metals and explosives exist from PA/SI investigation.	• No surface water samples will be collected • One sediment sample will be collected from a water collection area downgradient of the Bombing Target within Despain Gulch. The sample will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives, including nitroglycerin and PETN
			Groundwater • Not an affected media under current land use.	- Incomplete pathway.	• Incomplete pathway. .	• Incomplete pathway.	• Limited groundwater data for exists from PA/SI investigation.	• No groundwater samples will be collected
			Air • Potentially affected media due to blowing soil.	Potentially complete Pathway Exposure routes: Inhalation	Incomplete Pathway	Potentially complete Pathway Exposure routes: Inhalation	• Limited data for metals and explosives exist from PA/SI investigation.	Will use soil analytical data in risk screening

Table 4. Proposed Sampling Approach
Cold Springs Precision Bombing Range

Area of Concern	Media	Samples	Select Metals	TAL Metals and molybdenum	Explosives	PETN	Nitroglycerin
Bombing Target	Soil	2	2	0	2	2	2
	Sediment	1	1	0	1	1	1
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
Background	Soil	10	0	10	0	0	0
	Sediment	1	0	1	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
		Totals	3	11	3	3	3

QC Required Samples	Media	Samples	Select Metals	TAL Metals and molybdenum	Explosives	PETN	Nitroglycerin
Duplicate	Soil	3	1	2	1	1	1
	Sediment	1	0	1	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
		Totals	1	3	1	1	1
MS/MSD	Soil	1	1	1	1	1	1
	Sediment	0	0	0	0	0	0
	Surface Water	0	0	0	0	0	0
	Groundwater	0	0	0	0	0	0
		Totals	1	1	1	1	1

Notes:

1) In addition to the QC samples shown above, temperature blanks will be submitted with samples, one blank per cooler.

2) Metals by SW-846 6020A. Explosives by SW-846 8330A. PETN and Nitroglycerin by SW-845 8330A (Modified).

3) Select metals are aluminum, chromium, copper, iron, lead, manganese, and nickel.

MS/MSD - matrix spike/matrix spike duplicate

PETN - pentaerythritol tetranitrate

QC - quality control

TAL - Target Analyte List

Table 5. Human Health Screening Criteria for Soil/Sediment at Oregon Sites

Analyte	Abbreviation	CAS No.	Region 9 Human Health Screening Values [a]			Laboratory Method Detection Limit (mg/kg)
			Residential PRG[b] (mg/kg)[b]	SSLs[c] DAF=1 (mg/kg)	SSLs[c] DAF=20 (mg/kg)	
Aluminum	Al	7429-90-5	76,000			20.0
Chromium[e]	Cr	7440-47-3	210	2	38	1.0
Copper	Cu	7440-50-8	3,100			1.0
Iron	Fe	7439-89-6	23,000			15.0
Lead	Pb	7439-92-1	400[f]			1.0
Manganese	Mn	7439-96-5	1,800			25.0
Magnesium	Mg	7439-95-4				0.5
Mercury	Hg	7439-97-6	23			0.5
Molybdenum	Mo	7439-98-7	390			0.06
Nickel	Ni	7440-02-0	1,600	7	130	1.0
Zinc	Zn	7440-66-6	23,000	620	12,000	2.0
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	4.4			0.075
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	3,100			0.050
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	16			0.040
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	1,800			0.020
1,3-Dinitrobenzene	1,3-DNB	99-65-0	6.1			0.020
2,4-Dinitrotoluene[d]	2,4-DNT	121-14-2	0.72	0.00004	0.0008	0.040
2,6-Dinitrotoluene[d]	2,6-DNT	606-20-2	0.72	0.00004	0.0008	0.040
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	12			0.040
2-Nitrotoluene	2-NT	88-72-2	0.88			0.075
3-Nitrotoluene	3-NT	99-08-1	730			0.050
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	12			0.040
4-Nitrotoluene	4-NT	99-99-0	12			0.040
Nitrobenzene	NB	98-05-3	20	0.007	0.1	0.020
Nitroglycerin	NG	55-63-0	35			
PETN	PETN	78-11-5	0.50	NVA	NVA	
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	610			0.065

DAF = Dilution Attenuation Factor. mg/kg = milligrams per kilogram.
PRG = Preliminary Remediation Goal. mg/L = milligrams per iter.
SSL = Soil Screening Level.

a If laboratory cannot meet any of the preferred QLs with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL. In those cases, the QL achievable with a routine SW 846 methodology would be accepted.
b PRGs from Region 9 PRG Table dated October 2004 and addendum dated 28 December 2004, based on single chemical.
c SSLs from Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004.
d Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.
e Total chromium values used.
f Values listed from Oregon risk-based concentrations: 400 mg/kg (residential)

Table 6
Human Health Screening Criteria for Groundwater at Oregon Sites [a]

Analyte	Abbreviation	CAS No.	Laboratory Method Detection Limit (µg/L)	Region 9 Tap Water PRG [b] (µg/L)	Federal Drinking Water Criteria MCLs [c] (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.8	0.61	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.4	1,800	
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.3	2.2	
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.2	1,100	
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.2	3.6	
2,4-Dinitrotoluene [d]	2,4-DNT	121-14-2	0.3	0.099	
2,6-Dinitrotoluene [d]	2,6-DNT	606-20-2	0.3	0.099	
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.2	7.3	
2-Nitrotoluene	2-NT	88-72-2	0.4	0.049	
3-Nitrotoluene	3-NT	99-08-1	0.8	120	
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.2	7.3	
4-Nitrotoluene	4-NT	99-99-0	0.4	0.66	
Nitrobenzene	NB	98-05-3	0.2	3.4	
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	0.75	360	
Nitroglycerin	NG	55-63-0	0.5		
PETN	PETN	78-11-5	1.3		
Aluminum	Al	7429-90-5	60	36,000	50 [e]
Chromium [f]	Cr	7440-47-3	2.0	110	100
Copper	Cu	7440-50-8	3.0	1,500	1,000 [e] 1,300 [g]
Iron	Fe	7439-89-6	5.0	11,000	300 [e]
Lead	Pb	7439-92-1	1.0		15 [g]
Magnesium	Mg	7439-95-4	100		
Manganese	Mn	7439-96-5	2.0	880	50 [e]
Mercury	Hg	7439-97-6	0.3		
Molybdenum	Mo	7439-98-7	5.0	180	
Nickel	Ni	7440-02-0	1.0	730	
Zinc	Zn	7440-66-6	0.1	11,000	5,000 [e]

Table 6 (Cont.)
Human Health Screening Criteria for Groundwater at Oregon Sites

MCL = Maximum Contaminant Level
PRG = Preliminary Remediation Goal
µg/L = micrograms per liter

a If laboratory cannot meet these QLs with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL.
Note that no surface water samples are planned at this time. If surface water is collected, additional human health screening criteria will be compiled.
b Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004, based on single chemical.
c Primary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004, is listed unless otherwise indicated.
d Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.
e Secondary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.
f Total chromium values used if available.
g Action level from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.

Table 7
Human Health Screening Criteria for Surface Water at Oregon Sites [a]

Analyte	Abbreviation	CAS Number	USEPA Region 9 Tap Water PRG[b] (µg/L)	Oregon DEQ Water Quality Criteria[c]	
				Water and Fish Ingestion[d] (µg/L)	Fish Consumption Only[e] (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.61		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	1,800		
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	2.2		
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	1,100		
1,3-Dinitrobenzene	1,3-DNB	99-65-0	3.6		
2,4-Dinitrotoluene[g]	2,4-DNT	121-14-2	0.099	0.11[h]	9.1[h]
2,6-Dinitrotoluene[g]	2,6-DNT	606-20-2	0.099		
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	7.3		
2-Nitrotoluene	2-NT	88-72-2	0.049		
3-Nitrotoluene	3-NT	99-08-1	120		
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	7.3		
4-Nitrotoluene	4-NT	99-99-0	0.66		
Nitrobenzene	NB	98-05-3	3.4	19,800	
Nitroglycerin	NG	55-63-0	4.8		
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	360		
Pentaerythritol tetranitrate	PETN	78-11-5			
Aluminum	Al	7429-90-5	36,000		
Chromium[i]	Cr	7440-47-3	110	50	
Copper	Cu	7440-50-8	1,500		
Iron	Fe	7439-89-6	11,000	300	
Lead	Pb	7439-92-1		50	
Magnesium	Mg	7439-95-4			
Manganese	Mn	7439-96-5	880	50	100
Mercury	Hg	7439-97-6	11	0.144	0.146
Molybdenum	Mo	7439-98-7	180		
Nickel	Ni	7440-02-0	730	13.4	100

Table 7
Human Health Screening Criteria for Surface Water at Oregon Sites [a]

Analyte	Abbreviation	CAS Number	USEPA Region 9 Tap Water PRG[b] (µg/L)	Oregon DEQ Water Quality Criteria[c]	
				Water and Fish Ingestion[d] (µg/L)	Fish Consumption Only[e] (µg/L)
Zinc	Zn	7440-66-6	11,000		

MCL = Maximum Contaminant Level
PRG = Preliminary Remediation Goal
µg/L = micrograms per liter

[a] If laboratory cannot meet these QLs with routine SW 846 methodology (as supported by MDLs that are no greater than 1/3 QL), laboratory's QL must be identified in laboratory submittal as failing to meet the QL. Some screening values cannot be obtained with routine methodology to the QL.
[b] Preliminary Remediation Goal (PRG) table, dated October 2004 and revision note dated 28 December 2004. Values are based on a single chemical.
[c] Values from Oregon DEQ Water Quality Criteria (OAR 340 Division 41, Table 20).
[d] Values represent the maximum ambient water concentration for consumption of both contaminated water and fish or other aquatic organisms.
[e] Values represent the maximum ambient water concentration for consumption of fish or other aquatic organisms.
[f] Values represent the drinking water Maximum Contaminant Level.
[g] Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.
[h] Value is based on a cancer risk of 1.0×10^{-6}.
[i] Because the form of chromium has not yet been determined, the values for Chromium VI are used as a conservative measure.
j Value based on memorandum from Department of Defense entitled "Policy on DoD Required Actions Related to Perchlorate." Dated 26 January 2006.

Table 8
Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Level II Screening Level [a]	Proposed Benchmarks									Potential Bio accumulative Constituent? [h]	Final Ecological Screening Value Soil [i]	Practical Quantitation Limit
	Lowest Value for Plants/Inverts./ Birds/Mammals (mg/kg)	Region 5 ESLs [b] (2003) (mg/kg)	Region 7 [c] (mg/kg)		Region 8 [d] (mg/kg)		Region 10 [e] (mg/kg)		Other Values: Talmage et al. (1999) [f] or LANL (2005) [g] (mg/kg)			(mg/kg)	(mg/kg)
Metals/Inorganics													
Aluminum	50	NVA	50	EPA-R4	NVA		50	EPA-R4	5.5	LANL		50	20.0
Chromium (total)	0.4	0.4	26	SSL	26	SSL	26	SSL	2.3	LANL	Yes	0.4	1.0
Copper	50	5.4	60	ORNL	190	Dutch	60	ORNL	10	LANL	Yes	50	1.0
Iron	10	NVA	200	EPA-R4	NVA		200	EPA-R4	NVA			10	15.0
Lead	16	0.0537	11	SSL	11	SSL	11	SSL	14	LANL	Yes	16	1.0
Magnesium	NVA	NVA	440000	EPA-R4	NVA		440000	EPA-R4	NVA			NVA/Nutrient	25.0
Manganese	100	NVA	100	EPA-R4	NVA		100	EPA-R4	50	LANL		100	0.5
Mercury	0.1	0.1	0.00051	ORNL	0.00051	ORNL	0.00051	ORNL	0.013	LANL	Yes	0.1	0.06
Molybdenum	2	NVA	2	ORNL	2	ORNL	2	ORNL	NVA			2	0.5
Nickel	30	13.6	30	ORNL	30	ORNL	30	ORNL	20	LANL	Yes	30	1.0
Zinc	50	6.62	8.5	ORNL	8.5	ORNL	8.5	ORNL	10	LANL	Yes	50	2.0

Table 8 (Cont.)
Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Level II Screening Level [a]	Proposed Benchmarks									Potential Bio accumulative Constituent? [h]	Final Ecological Screening Value Soil [i]	Practical Quantitation Limit
	Lowest Value for Plants/Inverts./ Birds/Mammals (mg/kg)	Region 5 ESLs [b] (2003) (mg/kg)	Region 7 [c] (mg/kg)		Region 8 [d] (mg/kg)		Region 10 [e] (mg/kg)		Other Values: Talmage et al. (1999) [f] or LANL (2005) [g] (mg/kg)			(mg/kg)	(mg/kg)
Explosive													
2,4-Dinitrotoluene	NVA	1.28	1.28	EPA-R4	NVA		1.28	EPA-R4	0.52	LANL		1.28	0.040
2,6-Dinitrotoluene	NVA	0.0328	0.0328	EPA-R4	NVA		0.0328	EPA-R4	0.37	LANL		0.0328	0.040
2-Amino-4,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		2.1	LANL		2.1	0.040
4-Amino-2,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		0.73	LANL		0.73	0.040
1,3-Dinitrobenzene	NVA	0.655	0.655	EPA-R4	NVA		0.655	EPA-R4	0.073	LANL		0.655	0.020
HMX	NVA	NVA	NVA		NVA		NVA		27	LANL		27	0.050
Nitrobenzene	8	1.31	1.31	EPA-R4	NVA		1.31	EPA-R4	2.2	LANL		8	0.020
RDX	NVA	NVA	NVA		NVA		NVA		7.5	LANL		7.5	0.075
1,3,5-Trinitrobenzene	NVA	0.376	0.376	EPA-R4	NVA		0.376	EPA-R4	6.6	LANL		0.376	0.020
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		6.4	LANL		6.4	0.040
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.0	LANL		2.0	0.075
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		2.4	LANL		2.4	0.050
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		4.4	LANL		4.4	0.040
Tetryl	NVA	NVA	NVA		NVA		NVA		0.99	LANL		0.99	0.065
PETN	NVA	NVA	NVA		NVA		NVA		8600	LANL		8600	0.50
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		71	LANL		71	10

NVA: No value available

Table 8 (Cont.)
Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

a Oregon Department of Environmental Quality Screening Level Values (December 2001).
b Ecological Screening Levels (ESLs), U.S.EPA Region 5, August 2003.
c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: USEPA EcoSSLs; ORNL Efroymson values; USEPA Region 4 values; other published values.
d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: USEPA SSLs; Dutch Intervention Values or ORNL Efroymson values.
e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.
f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, **'Revisions Environmental Contaminant Toxicology.'**
g Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.
h Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).
i Final Screening Value selected using the following hierarchy:
    1. State Value (Oregon)
    2. USEPA Region State Located In (USEPA Region 10)
    3. Lower of Talmage et al. (1999) or LANL (2005) values.

EPA-R4=USEPA Region 4
LANL= Los Alamos National Laboratory
SSL=USEPA Eco Soil Screening Levels
Dutch=Dutch Intervention Values
ORNL= Oak Ridge National Laboratory Ecological PRGs (Efroymson et al)

Other References:

U.S. Environmental Protection Agency, 2005, Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), Office of Solid Waste and Emergency Response,
website version last updated March 15, 2005: http://www.epa.gov/ecotox/ecossl.
U.S. Environmental Protection Agency, 2001, Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995.
Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm.

Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. (ORNL) ES/ER/TM-162/R2.

Dutch Intervention Values:

Swartjes, F.A. 1999. Risk-based Assessment of Soil and Groundwater Quality in the Netherlands: Standards and Remediation Urgency. Risk Analysis 19(6): 1235-1249

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation http://www2.minvrom.nl/Docs/internationaal/S_I2000.pdf and Annex A:

Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination http://www2.minvrom.nl/Docs/internationaal/annexS_I2000.pdf

were also consulted.

Table 9
Selection of Ecological Surface Water Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Screening Level Values[a] (mg/L) Freshwater	Region 5 Ecological Screening Levels[b] (mg/L)	EPA Region 7 [c] (mg/L)		EPA Region 8 [d] (mg/L)		EPA Region 10 [e] (mg/L)		Other Values: Talmage et al. (1999) [f] or LANL (2005) [g] (mg/L)		Potential Bioaccumulative Constituent? [g]	Final Ecological Value Surface Water [h] (mg/L)	Practical Quantitation Limit (mg/L)
Metals/Inorganics													
Aluminum	8.70E-02	NVA	8.70E-02	AWQC	8.70E-02	AWQC	8.70E-02	AWQC	8.70E-02	LANL		8.70E-02	6.0E-02
Chromium (Cr-III)	7.40E-02	4.20E-02	7.40E-02	AWQC	7.40E-02	AWQC	7.40E-02	AWQC	7.70E-02	LANL	Yes	7.40E-02	2.0E-03
Copper	9.00E-03	1.58E-03	9.00E-03	AWQC	9.00E-03	AWQC	9.00E-03	AWQC	5.00E-03	LANL	Yes	9.00E-03	3.0E-03
Iron	1.00E+00	NVA	1.00E+00	AWQC	1.00E+00	AWQC	1.00E+00	AWQC	1.00E+00	LANL		1.00E+00	5.0E-02
Lead	2.50E-03	1.17E-03	2.50E-03	AWQC	2.50E-03	AWQC	2.50E-03	AWQC	1.20E-03	LANL	Yes	2.50E-03	1.0E-03
Magnesium	8.20E+01	NVA	NVA		NVA		NVA		NVA			8.20E+01	1.0E-01
Manganese	1.20E-01	NVA	1.20E-01	EPRG	1.20E-01	Tier II	1.20E-01	EPRG	8.00E-02	LANL		1.20E-01	2.0E-03
Mercury	7.70E-04	1.30E-06	7.70E-01	AWQC	7.70E-01	AWQC	7.70E-01	AWQC	7.70E-04	LANL	Yes	7.70E-04	3.0E-04
Molybdenum	3.70E-01	NVA	3.70E-01	EPRG	3.70E-01	Tier II	3.70E-01	EPRG	NVA			3.70E-01	5.0E-03
Nickel	5.20E-02	2.89E-02	5.20E-02	AWQC	5.20E-02	AWQC	5.20E-02	AWQC	2.80E-02	LANL	Yes	5.20E-02	1.0E-03
Zinc	1.20E-01	6.57E-02	1.20E-01	AWQC	1.20E-01	AWQC	1.20E-01	AWQC	6.60E-02	LANL	Yes	1.20E-01	1.0E-02

Table 9 (Cont.)
Selection of Ecological Surface Water Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Screening Level Values[a] (mg/L) Freshwater	Region 5 Ecological Screening Levels[b] (mg/L)	EPA Region 7 [c] (mg/L)		EPA Region 8 [d] (mg/L)		EPA Region 10 [e] (mg/L)		Other Values: Talmage et al. (1999) [f] or LANL (2005) [g] (mg/L)		Potential Bioaccumulative Constituent? [g]	Final Ecological Value Surface Water [h] (mg/L)	Practical Quantitation Limit (mg/L)
Explosives													
RDX	NVA	NVA	NVA		NVA		NVA		1.90E-01	TAL		1.90E-01	8.0E-04
HMX	NVA	NVA	NVA		NVA		NVA		3.30E-01	TAL		3.30E-01	4.0E-04
1,3-Dinitrobenzene	NVA	2.20E-02	NVA		NVA		NVA		2.00E-02	TAL		2.00E-02	2.0E-04
1,3,5-Trinitrobenzene	NVA	NVA	NVA		NVA		NVA		1.00E-02	TAL		1.00E-02	2.0E-04
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		8.00E+00	LANL		8.00E+00	4.0E-04
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		9.60E+00	LANL		9.60E+00	8.0E-04
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		1.70E+01	LANL		1.70E+01	4.0E-04
2,4-Dinitrotoluene	2.30E-01	4.40E-02	NVA		NVA		NVA		3.10E-01	LANL		2.30E-01	3.0E-04
2,6-Dinitrotoluene	2.30E-01	8.10E-02	NVA		NVA		NVA		6.00E-02	LANL		2.30E-01	3.0E-04
2-Amino,4,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		2.00E-02	TAL		2.00E-02	2.0E-04
4-Amino-2,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		8.60E+00	LANL		8.60E+00	2.0E-04
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		9.00E-02	TAL		9.00E-02	3.0E-04
Nitrobenzene	5.40E-01	2.20E-01	NVA		NVA		NVA		2.70E-01	LANL		5.40E-01	2.0E-04
Tetryl	NVA	NVA	NVA		NVA		NVA		5.80E+00	LANL		5.80E+00	7.5E-04
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		4.30E+02	LANL		4.30E+02	5.0E-02
PETN	NVA	NVA	NVA		NVA		NVA		2.60E+04	LANL		2.60E+04	1.3E-03

NVA = No Value Available

Table 9 (Cont.)
Selection of Ecological Surface Water Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

a Oregon Department of Environmental Quality Screening Level Values (December 2001).
b Ecological Screening Levels (ESLs), U.S.EPA Region 5, August 2003.
c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: National Ambient Water Quality Criteria; ORNL Efroymson values (ORNL, 1977).
d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: National Ambient Water Quality Criteria; Great Lakes Tier II Values; Canadian Environmental Quality Guidelines (CCME, 2003) or ORNL Efroymson values (ORNL, 1977).
e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.
f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. Revisions Environmental Contaminant Toxicology.'
g Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005**.**
h Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).
i Final Screening Value selected using the following hierarchy:
1. State Value (Oregon)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

AWQC=National Ambient Water Quality Criteria
LANL= Los Alamos National Laboratory
Tier II=Great Lakes Tier II Water Quality Criteria
EPRGs=Oak Ridge National Laboratory Ecological PRGs
TAL=Talmage et al (1999)
CCME=Canadian Council of Ministers of the Environment, Environmental Quality Guidelines

Other References:

Efroymson, R.A., et al., 1997, Preliminary Remediation Goals (EPRGs), ORNL, ES/ER/TM-162/R2,
Canadian Environmental Quality Guidelines (for Freshwater) Summary Table, CCME, December 2003.
Great Lakes Tier II Values from Suter, G.W. and C.L. Tsao, 1996, Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Rev, ES/ER/TM-96/R2.
National AWQC from USEPA Water Quality Criteria Web Site: http://www.epa.gov/waterscience/criteria/wqcriteria.html

Table 10
Selection of Ecological Sediment Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Screening Level Values [a] (mg/kg) Freshwater	Region 5 Ecological Screening Levels[b] (mg/kg)	EPA Region 7 [c] (mg/kg)		EPA Region 8 [d] (mg/kg)		EPA Region 10 [e] (mg/kg)		Other Values: Talmage et al. (1999) [f] or LANL (2005) [g] (mg/kg)		Potential Bioaccumulative Constituent? [g]	Final Ecological Screening Value Sediment [h] (mg/kg)	Practical Quantitation Limit (mg/kg)
Metals/Inorganics													
Aluminum	NVA	NVA	NVA		NVA		NVA		2.80E+02	LANL		2.80E+02	20.0
Chromium	3.70E+01	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	3.70E+01	1.0
Copper	1.00E+01	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	1.00E+01	1.0
Iron	NVA	NVA	NVA		NVA		NVA		2.00E+01	LANL		2.00E+01	15.0
Lead	3.50E+01	3.58E+01	3.58E+01	MAC	3.58E+01	MAC	3.58E+01	MAC	2.70E+01	LANL	Yes	3.50E+01	1.0
Magnesium	NVA	NVA	NVA		NVA		NVA		NVA			NVA	25.0
Manganese	1.10E+03	NVA	NVA		NVA		NVA		7.20E+02	LANL		1.10E+03	0.5
Mercury	2.00E-01	1.74E-01	1.80E-01	MAC	1.80E-01	MAC	1.80E-01	MAC	1.80E-02	LANL	Yes	2.00E-01	0.06
Molybdenum	NVA	NVA	NVA		NVA		NVA		NVA			NVA	0.5
Nickel	1.80E+01	2.27E+01	2.27E+01	MAC	2.27E+01	MAC	2.27E+01	MAC	3.90E+01	LANL	Yes	1.80E+01	1.0
Zinc	3.00E+00	1.21E+02	1.21E+02	MAC	1.21E+02	MAC	1.21E+02	MAC	3.70E+01	LANL	Yes	3.00E+00	2.0

Table 10 (Cont.)
Selection of Ecological Sediment Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Screening Level Values [a] (mg/kg) Freshwater	Region 5 Ecological Screening Levels[b] (mg/kg)	EPA Region 7 [c] (mg/kg)		EPA Region 8 [d] (mg/kg)		EPA Region 10 [e] (mg/kg)		Other Values: Talmage et al. (1999) [f] or LANL (2005) [g] (mg/kg)		Potential Bioaccumulative Constituent? [h]	Final Ecological Screening Value Sediment [i] (mg/kg)	Practical Quantitation Limit (mg/kg)
Explosives													
RDX	NVA	NVA	NVA		NVA		NVA		1.30E-01	TAL		1.30E-01	0.075
HMX	NVA	NVA	NVA		NVA		NVA		4.70E-02	TAL		4.70E-02	0.050
1,3,5-Trinitrobenzene	NVA	NVA	NVA		NVA		NVA		2.40E-02	TAL		2.40E-02	0.020
1,3-Dinitrobenzene	NVA	8.61E-03	NVA		NVA		NVA		6.70E-02	TAL		6.70E-02	0.020
2,4-Dinitrotoluene	NVA	1.44E-03	NVA		NVA		NVA		2.90E-01	LANL		2.90E-01	0.040
2,6-Dinitrotoluene	NVA	3.98E-03	NVA		NVA		NVA		1.90E+00	LANL		1.90E+00	0.040
2,4,6-TNT	NVA	NVA	NVA		NVA		NVA		9.20E-01	TAL		9.20E-01	0.040
2-Amino-4,6,-Dintrotoluene	NVA	NVA	NVA		NVA		NVA		7.00E+00	LANL		7.00E+00	0.040
4-Amino-2,6,-Dintrotoluene	NVA	NVA	NVA		NVA		NVA		1.90E+00	LANL		1.90E+00	0.040
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		5.60E+00	LANL		5.60E+00	0.075
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		4.90E+00	LANL		4.90E+00	0.050
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		1.00E+01	LANL		1.00E+01	0.040
Nitrobenzene	NVA	1.45E-01	NVA		NVA		NVA		3.20E+01	LANL		3.20E+01	0.020
Tetryl	NVA	NVA	NVA		NVA		NVA		1.00E+02	LANL		1.00E+02	0.065
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		1.70E+03	LANL		1.70E+03	10
PETN	NVA	NVA	NVA		NVA		NVA		1.20E+05	LANL		1.20E+05	0.50

NVA = No Value Available

Table 10 (Cont.)
Selection of Ecological Sediment Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

a Oregon Department of Environmental Quality Screening Level Values (December 2001).
b Ecological Screening Levels (ESLs), U.S.EPA Region 5, August 2003.
c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); ORNL Efroymson values (ORNL, 1977).
d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); Canadian ISQG values (CCME, 2003) or ORNL Efroymson values (ORNL, 1977).
e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.
f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, Revisions Environmental Contaminant Toxicology.'
g Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.
h Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation. Potential bioaccumulative potential from: Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).
i Final Screening Value selected using the following hierarchy:
   1. State Value (Oregon)
   2. USEPA Region State Located In (USEPA Region 10)
   3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

Note: The Talmage [TAL] screening values assume 10% organic carbon in the sediment.

MAC=MacDonald Consensus Values
EPRGs=Oak Ridge National Laboratory Ecological PRGs
ISQGs=Canadian Interim Sediment Quality Guidelines
LALN=Los Alamos National Laboratory
TAL=Talmage et al (1999)

Other References:
Efroymson, R.A., et al., 1997, Preliminary Remediation Goals (EPRGs), ORNL, ES/ER/TM-162/R2,
Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003.
MacDonald, D.D, C.G. Ingersoll and T.A. Berger, 2000, Development and Evaluation of Consensus-Based Sediment Quality Criteria for Freshwater Ecosystems, Archives of Environmental Contamination and Toxicology 39:20-31.

Draft Worksheets

Site Information Worksheet

Site: Cold Springs Precision Bombing Range

Project: Cold Springs Precision Bombing Range

	Site Information Needed[a]	Suggested Means to Obtain Site Information	Potential Source(s) of Site Information	Responsible for Obtaining	Deadline for Obtaining Site Information
1	Schedule for Sampling	Consultation	ODEQ and landowners	Shaw	Prior to field work
2	Point of Contact for Community	Not Applicable	USACE	USACE	Prior to field work
3	Access Agreements	Correspondence, call, or visit stakeholders	Letters/conversations with stakeholders	USACE	Prior to field work
4	Areas of Cultural Significance within AOC	SHPO	Phone SHPO	Shaw	For inclusion in final TPP Memo

Cold Springs Bombing Range HRS Data Gaps

Information required to complete the MEC-HRS data collection form:

1. Determine the latitude / longitude of the site boundary.
2. Confirm the area of the site, v. the area of all source(s).

Item	Number	Comment – Missing Data Element
1	1.8	Source scale (i.e., 1:24,000, etc.)
2	1.12	Site Permits
3	1.16	Site with unknown source
4	2.4	Confirm if there are other NPL sites within 1-mile of the site.
5	3.3	Waste treatment, storage, and disposal activities.
6	3.4	Source(s):
7	5.1	Workers on site
8	5.2	Distance to population
9	5.3	Population within 1 mile, within 4 miles
10	6	Water use (GW within 4 miles, SW within 15 miles)
11	6.1	Total drinking water population served
12	6.2	Type of drinking water supply system (GW or SW?)
13	6.3	Other water uses of GW within 4-miles
14	6.4	Aquifer depth
15	6.5	Surface Water uses
16	8	Response Actions
17	8.1	Types of action(s) that have occurred at or near the site?
18	8.2	Who did the action? (EPA, Private parties, other, etc.?)

Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CRF Part 179

Installation: Cold Springs Precision Bombing Range
AOC: Bombing target
RMIS Range ID: F10OR0172

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	M38A2 100-lb practice bombs with black powder, black smoke, or FS smoke spotting charges
	2	Source of Hazard			x	Former practice bombing target
	3	Location of Munitions			x	Historical evidence indicates munition debris litters the site. Confirmed presence of MEC; 37-mm live artillery round found in 1975
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard	X			0 inhabited structures w/in 2 miles
	8	Activities/Structures			x	Agricultural - irrigated crops and livestock grazing
	9	Ecological and/or Cultural Resources			x	Ecological resources present
	10	**EHE Module Score**				
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard	x			0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	**CHE Module Score**				
Health Hazard Evaluation (HHE)	21	HHE Factor Levels	x	Contaminant hazard evaluation pending analytical results		
	22	HHE Three-Letter Combination Levels	x	Contaminant hazard evaluation pending analytical results		
	23	HHE Module Ratings	x	Contaminant hazard evaluation pending analytical results		
	24	HHE Module Rating	x	Contaminant hazard evaluation pending analytical results		
MRS Priority	**25**	**MRS Priority (Based on Highest Hazard Evaluation Module Rating)**	**x**	**Evaluation pending filling of data gaps**		

To be completed by USACE once all data gaps are filled.

PA/SI Summary

Site Inspection
Cold Springs Precision Bombing Range

Technical Project Planning Meeting
April 19, 2007

Table 6-1—Potential Sources: Bombing Range Analytical Results
Cold Springs PBR FUDS PA/SI
Umatilla County, Oregon

Description	Background	Potential Source							
Field Number	SS-BK001	SS-CB001	SB-CB001	SS-CB002	SB-CB002	SS-CB003	SB-CB003	SS-CS001	SS-BS001
EPA Number	04494268	04494250	04494251	04494253	04494254	04494255	04494256	04494257	04494252
CLP Number	MJ4A70	MJ4A53	MJ4A54	MJ4A56	MJ4A57	MJ4A58	MJ4A59	NA	MJ4A55
Location	Background Soil	Surface Soil at Bombing Range	Subsurface Soil at Bombing Range	Surface Soil at Bombing Range	Subsurface Soil at Bombing Range	Surface Soil at Bombing Range	Subsurface Soil at Bombing Range	Caliche Soil	Soil From within Practice Bomb Casing
Inorganics (mg/kg)									
Aluminum	6610	6320	7660	7370	8580	6010	5560	—	4860
Antimony	0.53 U	0.53 U	0.53 U	0.48 U	0.72 U	0.50 U	0.41 U	—	0.48 U
Arsenic	**3.5**	**2.7**	**4.4**	**6.3**	**6.0**	**1.9**	**1.8**	—	**2.6**
Barium	**104**	**101**	**113**	**99.4**	**123**	**84.7**	**81.9**	—	**81.4**
Beryllium	0.05 U	0.02 U	0.11 BJK	0.15 BJK	0.16 BJK	0.61 U	0.51 U	—	0.52 U
Cadmium	0.53 U	0.54 U	0.53 U	0.55 U	0.53 U	0.61 U	0.51 U	—	0.52 U
Calcium	**16800 JK**	**6440 JK**	**21200 JK**	**12900 JK**	**10600 JK**	**3200 JK**	**2970 JK**	—	**9770 JK**
Chromium	**9.0**	**7.9**	**10.4**	**11.1**	**13.6**	**7.4**	**6.5**	—	**5.4**
Cobalt	**6.8**	**6.9**	**7.1**	**7.3**	**8.1**	**6.4**	**6.0**	—	**7.5**
Copper	**11.9 JK**	**11.9 JK**	**14.3 JK**	**17.4 JK**	**17.0 JK**	**11.6 JK**	**9.2 JK**	—	**13.4 JK**
Iron	**16300**	**16200**	**16500**	**16000**	**17800**	**16400**	**15800**	—	**20700**
Lead	**5.9**	**4.7**	**5.9**	**8.3**	**7.6**	**5.2**	**3.9**	—	**3.6**
Magnesium	**5480 JK**	**3780 JK**	**5650 JK**	**5920 JK**	**6380 JK**	**3310 JK**	**3040 JK**	—	**3800 JK**
Manganese	**303 JK**	**328 JK**	**328 JK**	**346 JK**	**378 JK**	**312 JK**	**296 JK**	—	**330 JK**
Mercury	0.11 U	0.11 U	0.02 BJK	0.11 U	0.11 U	0.12 U	0.10 U	—	0.10 U
Nickel	**10.1**	**9.5**	**11.4**	**12.4**	**14.4**	**8.3**	**7.8**	—	**7.5**
Potassium	**1500**	**1590**	**1760**	**1740**	**2000**	**1700**	**1460**	—	**815**
Selenium	3.7 UJK	3.8 UJK	3.7 UJK	3.8 UJK	3.7 UJK	4.2 UJK	3.6 UJK	—	3.6 UJK
Silver	**1.1**	**1.2**	1.0 BJK	**1.1**	**1.2**	**1.2 JK**	**1.2**	—	**1.4**
Sodium	159 BJK	142 BJK	142 BJK	133 BJK	176 BJK	133 BJK	116 U	—	229 BJK
Thallium	1.8 U	2.2 BJK	2.2 BJK	2.1 BJK	2.1 BJK	2.1 BJK	2.0 BJK	—	2.5 BJK
Vanadium	**33.5**	**34.6**	**34.6**	**29.8**	**33.3**	**36.8**	**36.8**	—	**42.3**
Zinc	**38.2 JK**	**33.7 JK**	**40.2 JK**	**41.1 JK**	**44.6 JK**	**39.6 JK**	**31.3 JK**	—	**34.5 JK**
Perchlorate Method 314.0 (mg/kg)									
Perchlorate	0.020 U	**0.83**	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Nitrate Base Explosive Compounds (mg/kg)									
1,3,5-Trinitrobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
1,3-Dinitrobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
2,4,6-Trinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
2,4-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
2,6-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
2-Amino-4,6-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
2-Nitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
3-Nitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
4-Amino-2,6-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
4-Nitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
HMX	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
Nitrobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
RDX	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U
Tetryl	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—	0.20 U

Notes:
Bold type indicates the sample concantration above the Sample Quantitation Limit (SQL).
Bold Underline type indicates a sample concentration that is significant as defined in Section 5
mg/kg: milligram per kilogram

Data Qualifiers:
BJK: Analyte positively detected. Reported result lies between the MDL and SQL and reported as an estimated quantity. Unknown bias.
JK: The analyte was positively identified. The associated numerical value is an unknown low-bias estimate
JL: The analyte was positively identified. The associated numerical value is a low-bias estimate
U: The analyte was analyzed for but not detected. The associated numerical value is the sample quantitation limit.
UJK: The analyte was analyzed for but not detected. The associated numerical value is an unknown bias estimate.

Table 7-2—Groundwater Domestic Wells Analytical Results
Cold Springs PBR FUDS PA/SI
Umatilla County, Oregon

Description	Target				
Field Number	GW-DW001	GW-DW002	GW-DW003	GW-DW004	GW-DW005
EPA Number	04494264	04494265	04494269	04494270	04494275
CLP Number	MJ4A66	MJ4A67	MJ4A71	MJ4A72	MJ4A77
Location	Ramirez Well	Messenger Well	Stahl Hutterian Well	Hat Rock State Park	Schmittle Well
Inorganics (µg/L)					
Aluminum	200 U	200 U	200 U	200 U	200 U
Antimony	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5.0 U	5.2 U	5.4 U	10.7 U	12.9 U
Barium	80.9 BJK	56.0 BJK	25.8 BJK	66.0 BJK	72.0 BJK
Beryllium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Cadmium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	**86200**	**38200**	**9360**	**77100**	**59600**
Chromium	10.0 U	10.0 U	10.0 U	0.99 BJK	10.0 U
Cobalt	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Copper	25.0 U	4.4 BJK	25.0 U	9.1 BJK	7.3 BJK
Iron	**226**	100 U	100 U	**114**	100 U
Lead	10.0 U	10.0 U	10.0 U	3.3 U	10.0 U
Magnesium	**31300**	**13500**	3330 BJK	**23500**	**32300**
Manganese	**262**	0.31 U	**25.8**	0.23 U	**194**
Mercury	0.03 U	0.03 U	0.03 U	0.04 U	0.04 U
Nickel	40.0 U	40.0 U	40.0 U	40.0 U	1.8 U
Potassium	**14300**	**7060**	**16600**	**8260**	**5620**
Selenium	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Sodium	**42100**	**54300**	**79700**	**36500**	**33700**
Thallium	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	50.0 U	41.5 BJK	39.4 BJK	21.1 BJK	34.6 BJK
Zinc	32.0 BJK	17.0 BJK	34.6 BJK	**541**	**101**
Perchlorate Method 314.0 (µg/L)					
Perchlorate	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Perchlorate Method 8321A-mod (µg/L)					
Perchlorate	1.0 U	**0.25**	**0.30**	**1.2**	0.20 U
Nitrate Base Explosive Compounds (µg/L)					
1,3,5-Trinitrobenzene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
1,3-Dinitrobenzene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
2,4,6-Trinitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
2,4-Dinitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
2,6-Dinitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
2-Amino-4,6-Dinitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
2-Nitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
3-Nitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
4-Amino-2,6-Dinitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
4-Nitrotoluene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
HMX	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
Nitrobenzene	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
RDX	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U
Tetryl	0.48 U	0.48 U	0.48 U	0.48 U	0.52 U

Notes:
Bold type indicates the sample concentration above the Sample Quantitation Limit (SQL).
µg/L: micrograms per liter.

Data Qualifiers:
BJK: Analyte positively detected. Reported result lies between the MDL and SQL and reported as an estimated quantity. Unknown bias.
U: The analyte was analyzed for but not detected. The associated numerical value is the sample quantitation limit.

Table 7-3—Target Sediment Samples Analytical Results
Cold Springs PBR FUDS PA/SI
Umatilla County, Oregon

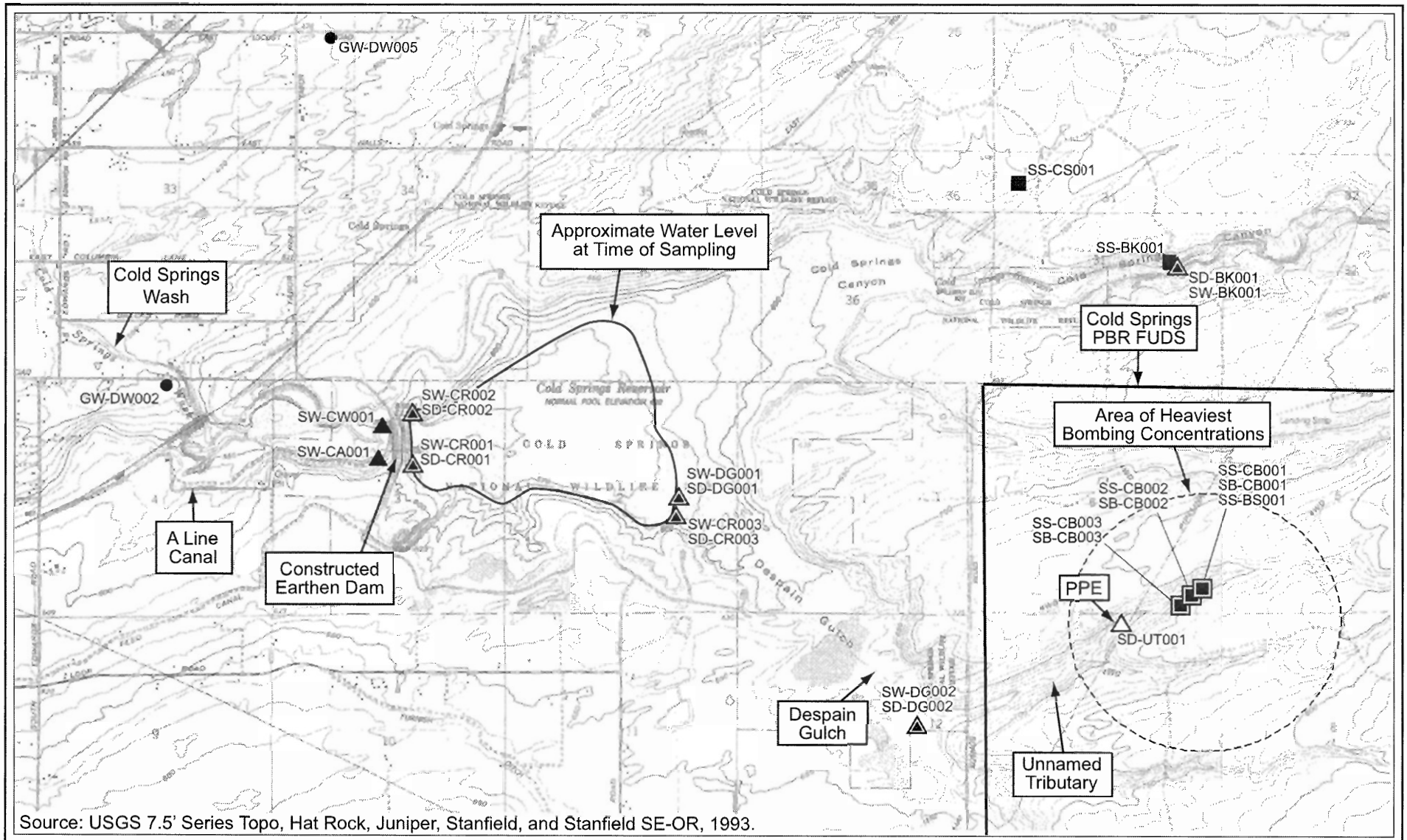
Description	Background	Targets					
Field Number	SD-BK001	SD-CR001	SD-CR002	SD-DG001	SD-CR003	SD-UT001	SD-DG002
EPA Number	04494267	04494261	04494263	04494272	04494274	04494276	04494278
CLP Number	MJ24A69	MJ24A63	MJ24A65	MJ24A74	MJ24A76	MJ24A78	MJ24A80
Location	Background Sediment	Southwest Corner of Cold Springs Reservoir	Northwest Corner of Cold Springs Reservoir	Sediment Sample at Despain Gulch and Cold Springs Reservoir Confluence	Cold Spring Reservoir South of the Confluence with Despain Gulch	Sediment Sample at the PPE in Unnamed Tributary	Despain Gulch Upstream of Confluence with Cold Springs Reservoir
Inorganics (mg/kg)							
Aluminum	**4030**	**8790**	**8530**	**4180**	**6450**	**8410**	**11400**
Antimony	0.65 U	0.71 U	0.61 U	0.62 U	0.73 U	0.86 U	0.68 U
Arsenic	**2.4**	**3.9**	**3.6**	**2.0**	**3.0**	**3.5**	**4.4**
Barium	**60.9**	**128**	**113**	**58.9**	**82.9**	**127**	**160**
Beryllium	0.72 U	0.11 BJK	0.07 U	0.67 U	0.75 U	0.07 U	0.20 BJK
Cadmium	0.72 U	0.72 U	0.67 U	0.67 U	0.75 U	0.70 U	0.79 U
Calcium	**5710 JL**	**3760 JL**	**3920 JL**	**3250 JL**	**4260 JL**	**12000 JL**	**5850 JL**
Chromium	**5.5**	**9.1**	**9.8**	**4.8**	**8.2**	**9.8**	**12.7**
Cobalt	6.1 BJK	**10.8**	**8.6**	4.9 BJK	**7.1 JK**	**8.3**	**8.8**
Copper	**7.1 JL**	**12.3 JL**	**14.0 JL**	**6.8 JL**	**9.0 JL**	**16.1 JL**	**20.5 JL**
Iron	**12900**	**21500**	**21100**	**14000**	**17300**	**20000**	**19800**
Lead	**2.8**	**7.2**	**6.5**	**2.9**	**4.1**	**6.7**	**7.6**
Magnesium	**2640 JL**	**3500 JL**	**4410 JL**	**2500 JL**	**4010 JL**	**5320 JL**	**4690 JL**
Manganese	**191 JL**	**674 JL**	**491 JL**	**216 JL**	**396 JL**	**316 JL**	**491 JL**
Mercury	0.14 U	0.02 BJK	0.02 BJK	0.13 U	0.15 U	0.14 U	0.02 BJK
Nickel	**5.6 JK**	**8.9**	**10.4**	**5.8**	**8.5**	**11.1**	**12.1**
Potassium	**994**	**1800**	**1800**	**944**	**1610**	**2470**	**3000**
Selenium	5.0 UJK	5.0 UJK	4.7 UJK	4.7 UJK	5.3 UJK	4.9 UJK	5.6 UJK
Silver	1.2 BJK	**1.6**	**1.7**	0.96 BJK	**1.3 JK**	**1.4**	**1.5 JK**
Sodium	310 BJK	200 BJK	216 BJK	246 BJK	237 BJK	**2010**	**620 JK**
Thallium	1.3 U	3.1 BJK	**2.7 JK**	1.7 U	2.1 BJK	2.3 BJK	2.5 BJK
Vanadium	**38.2**	**46.7**	**46.1**	**37.7**	**38.7**	**41.8**	**43.6**
Zinc	**28.9 JL**	**42.4 JL**	**43.8 JL**	**28.2 JL**	**35.9 JL**	**53.1 JL**	**46.9 JL**
Perchlorate Method 314.0 (mg/kg)							
Perchlorate	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Nitrate Base Explosive Compounds (mg/kg)							
1,3,5-Trinitrobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
1,3-Dinitrobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
2,4,6-Trinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
2,4-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
2,6-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
2-Amino-4,6-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
2-Nitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
3-Nitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
4-Amino-2,6-Dinitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
4-Nitrotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
HMX	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
Nitrobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
RDX	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—
Tetryl	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	—

Notes:
Bold type indicates the sample concentration above the detection limit
Bold underline type indicates a sample concentration that is significant as defined in Section 5
mg/kg: milligram per kilogram
— Constituent not analyzed

Data Qualifiers:
BJK: Analyte positively detected. Reported result lies between the MDL and SQL and reported as an estimated quantity. Unknown bias
JK: The analyte was positively identified. The associated numerical value is an unknown bias estimate
JL: The analyte was positively identified. The associated numerical value is a low-bias estimate
U: The analyte was analyzed for but not detected. The associated numerical value is the sample quantitation limi
UJK: The analyte was analyzed for but not detected. The associated numerical value is an unknown bias estimate

Table 7-4—Surface Water Sample Analytical Results
Cold Springs PBR FUDS PA/SI
Umatilla County, Oregon

Description	Background	Target						
Field Number	SW-BK001	SW-CA001	SW-CW001	SW-CR001	SW-CR002	SW-DG001	SW-CR003	SW-DG002
EPA Number	04494266	04494258	04494259	04494260	04494262	04494271	04494273	04494277
CLP Number	MJ4A68	MJ4A60	MJ4A61	MJ4A62	MJ4A64	MJ4A73	MJ4A75	MJ4A79
Location	Background Surface Water	Surface Water Sample at Line A Canal	Surface Water Sample at Line A Canal	Surface Water Sample at Cold Springs Reservoir on the Southwest Corner	Surface Water Sample at Cold Springs Reservoir on the Northwest Corner	Surface Water Sample at Despain Gulch and Cold Springs Reservoir Confluence	Surface Water Sample at Cold Spring Reservoir South of the Confluence with Despain Gulch	Surface Water Sample in Despain Gulch Upstream of Confluence with Cold Springs Reservoir
Inorganics (µg/L)								
Aluminum	200 U	278	200 U	865	872	2030	921	446
Antimony	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	14.5 U	14.0 U	**32.9**	10.0 U	10.0 U	10.4 U	4.2 U	6.8 U
Barium	200 BJK	44.0 BJK	53.1 BJK	75.6 BJK	78.8 BJK	181 BJK	86.7 BJK	114 BJK
Beryllium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Cadmium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	**89200**	**34700**	**50100**	**28500**	**28600**	**97900**	**37600**	**97900**
Chromium	10 BJK	10.0 U	10.0 U	10.0 U	0.55 BJK	1.1 BJK	10.0 U	10.0 U
Cobalt	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	1.4 U	50.0 U	50.0 U
Copper	25.0 U	2.0 BJK	25.0 U	1.6 BJK	1.6 BJK	4.4 BJK	1.5 BJK	1.5 BJK
Iron	100 U	**438**	**416**	**1240**	**1400**	**2830**	**1330**	**505**
Lead	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Magnesium	**56000**	**15600**	**20500**	**11700**	**11800**	**43800**	**17600**	**54800**
Manganese	4.5 U	**105**	**572**	**210**	**225**	**207**	**332**	**143**
Mercury	0.20 U	0.20 U	0.20 U	0.03 U	0.20 U	0.20 U	0.03 U	0.03 U
Nickel	40.0 U	40.0 U	40.0 U	1.4 U	40.0 U	2.3 U	40.0 U	40.0 U
Potassium	**13500**	4030 BJK	**7390**	3980 BJK	3980 BJK	**11200**	4730 BJK	**15400**
Selenium	35 BJK	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U	4.6 BJK
Silver	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Sodium	**194000**	**40800**	**50800**	**32000**	**32000**	**213000**	**39500**	**225000**
Thallium	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	**57.6**	39.2 BJK	35.6 BJK	4.1 BJK	4.8 BJK	39.8 BJK	5.1 BJK	31.9 BJK
Zinc	60 BJK	14.3 BJK	14.7 BJK	10.9 BJK	11.5 BJK	34.1 BJK	14.8 BJK	35.4 BJK
Perchlorate Method 314.0 (µg/L)								
Perchlorate	**7.68**	2.0 U	2.0 U	2.0 U	8 U	**12.0**	2.0 U	**3.63 J**
Perchlorate Method 8321A-mod (ug/L)								
Perchlorate	**7.6**	**0.39**	0.17 QJK	0.058 QJK	0.049 QJK	**1.1**	0.035 QJK	**3.7**
Nitrate Base Explosive Compounds (mg/L)								
1,3,5-Trinitrobenzene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
1,3-Dinitrobenzene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
2,4,6-Trinitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
2,4-Dinitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
2,6-Dinitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
2-Amino-4,6-Dinitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
2-Nitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
3-Nitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
4-Amino-2,6-Dinitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
4-Nitrotoluene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
HMX	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
Nitrobenzene	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
RDX	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U
Tetryl	0.51 U	0.62 U	0.49 U	0.52 U	0.54 U	0.64 U	0.49 U	0.49 U



Source: USGS 7.5' Series Topo, Hat Rock, Juniper, Stanfield, and Stanfield SE-OR, 1993.

0 1500 3000

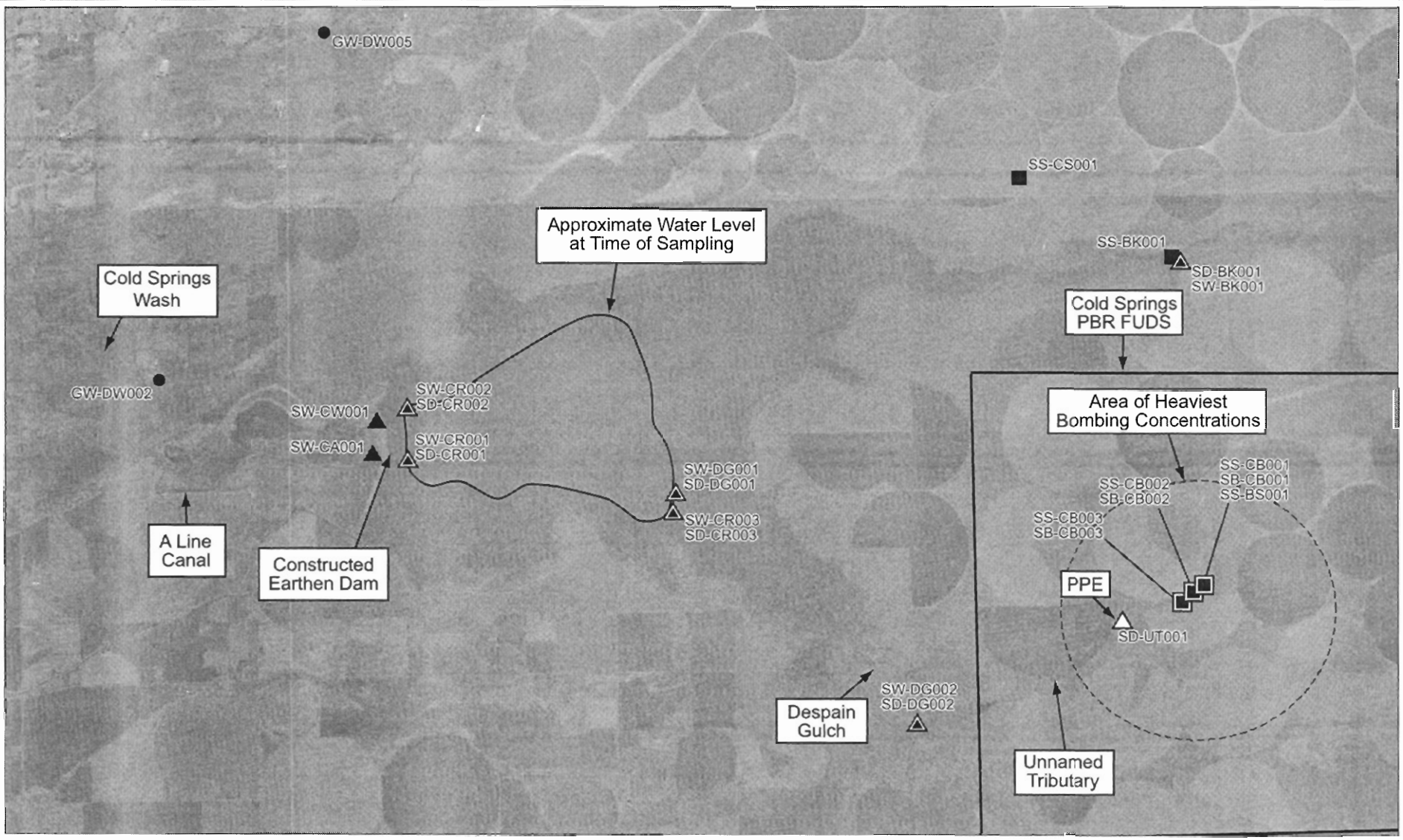
Scale in Feet

GW-DW005 Groundwater Sample Location
SD-CR001 Sediment Sample Location
SW-CA001 Surface Water Sample Location
SS-CB003 Soil Sample Location
SB-CB003 Subsurface Soil Sample Location

Sample Location Map Detail
Cold Springs Precision Bombing Range FUDS PA/SI
Umatilla County, OR

Figure
3-2

05-0068 Fig3-2.ai



0 1500 3000

Scale in Feet

GW-DW005 ● Groundwater Sample Location

SD-CR001 △ Sediment Sample Location

SW-CA001 ▲ Surface Water Sample Location

SS-CB003 ■ Soil Sample Location

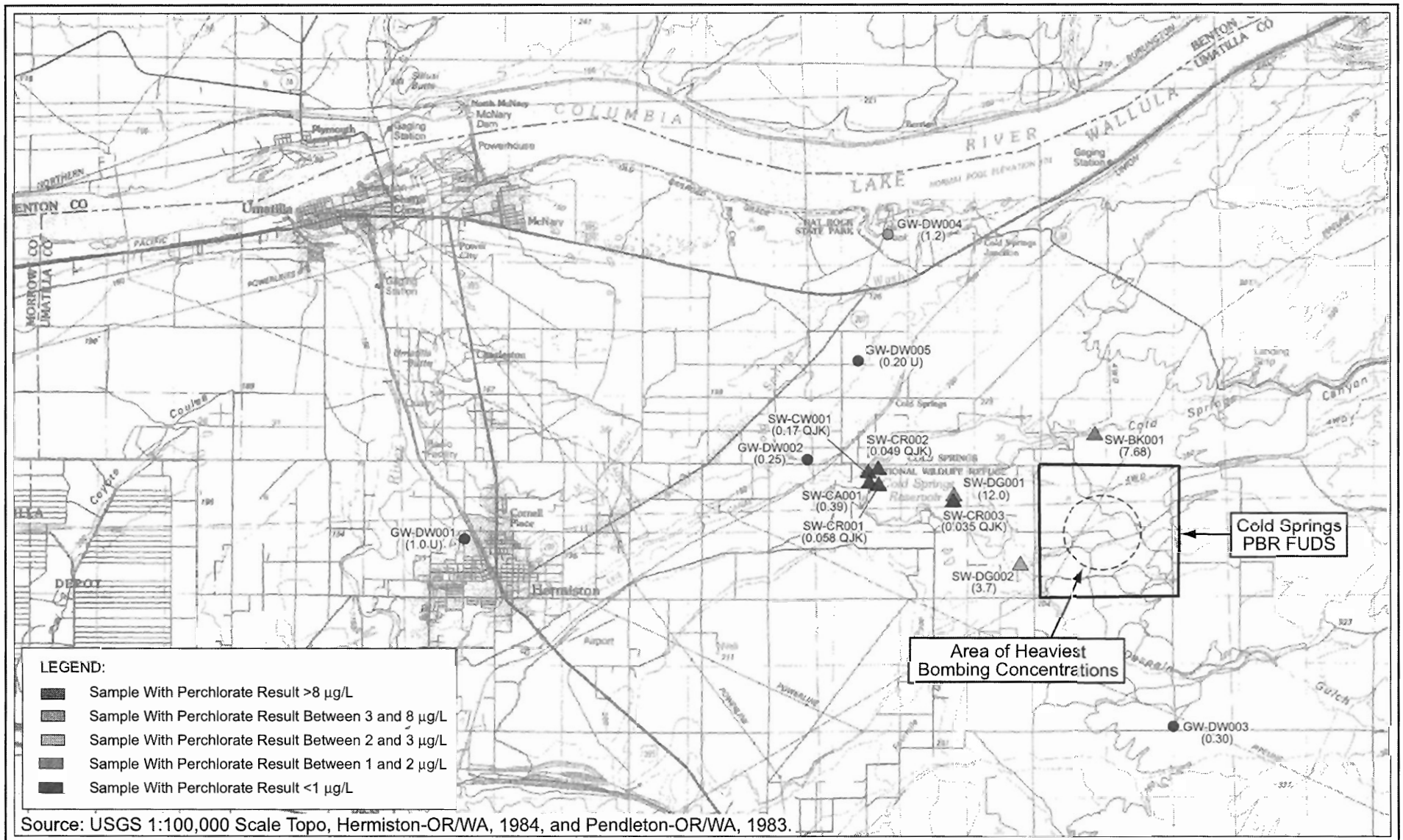
SB-CB003 □ Subsurface Soil Sample Location

Sample Location Map Detail with Aerial Photo
Cold Springs Precision Bombing Range FUDS PA/SI
Umatilla County, OR

Figure

3-3

05-0068 Fig3-3.ai



Source: USGS 1:100,000 Scale Topo, Hermiston-OR/WA, 1984, and Pendleton-OR/WA, 1983.

Cold Spring PBR FUDS PA/SI Perchlorate Results—December 2004

Cold Springs Precision Bombing Range FUDS PA/SI
Umatilla County, OR

N

0 1 2

Scale in Miles

GW-DW001 Station ID

(1.5) Perchlorate Concentration (µg/L)

○ Groundwater Sample Location

△ Surface Water Sample Location

WESTON SOLUTIONS

Figure

7-1

05-0068 Fig7-1.ai